The Electrical Industry's Weekly Magazine

January 19, 1959

Electrical World

Price 50 Cents

A McGraw-Hill Publication

TUSCARORA PUMP STORAGE PLANT

Niagara Project to Cost New York $705,000,000

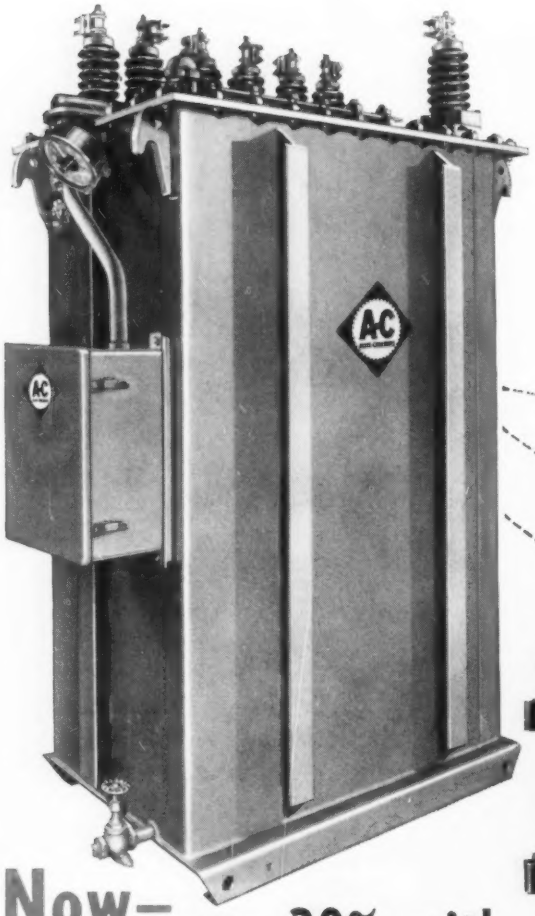
LEWISTON MAIN GENERATING PLANT

...page 34

STEVENS HICS
UNIVERSITY MICROFILMS
313 N 1 ST
ANN ARBOR MICH

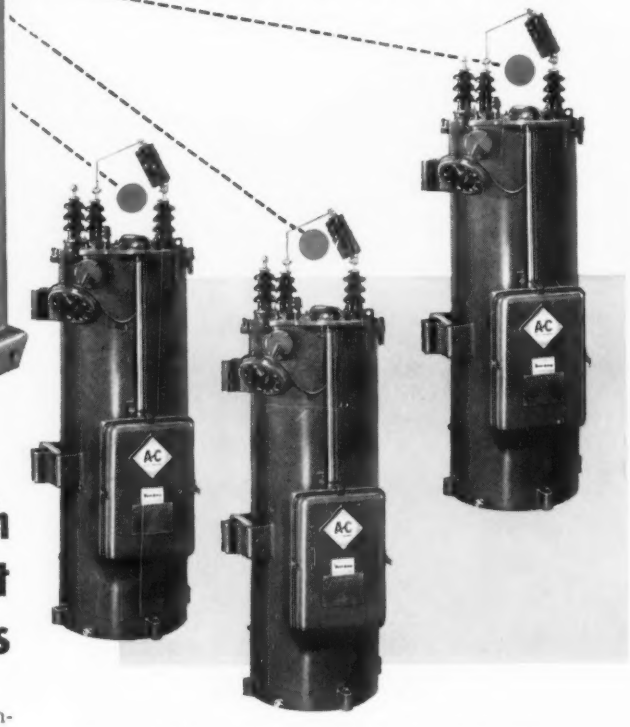
'Total-Electric Home' Program to Push Heat ... p

ALLIS-CHALMERS — 25 years of leadership in 5/8% regulators



Plan to stay ahead... MODERNIZE!

Save 30%...



Now— save 30% with one 3-phase unit or 3 single-phase units

The low-cost 3-phase distribution regulator is another Allis-Chalmers first in regulator development released in our 25th Anniversary year. It features these exclusive advantages:

1. **30% less cost for 3-phase regulation.**
2. **20% less weight for easier handling, faster installation.**
3. **33% less installation space.**
4. **160% *Vari-Amp* rating to 600-ampere maximum.**

Available ratings include: 500 and 750 kva, 8660 volts, and 500, 750 and 1000 kva, 13,200 volts — these regulators also available in forced-air ratings.

Mechanical features include the outstanding "Quick-Break" tap-changing mechanism, *Feather-Touch* control; unidirectional breather; and *Vari-Amp* rating.

This development completely changes the economics of 3-phase regulation. Savings are important enough to warrant re-evaluation of present substation commitments.

Get details from your nearby A-C office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Originators of 5/8% Step Regulators

ALLIS-CHALMERS

A-5857

Feather-Touch and Vari-Amp are Allis-Chalmers trademarks.

Electrical World

Vol. 151, No. 3 JANUARY 19, 1959

Published for 85 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

In This Week's Issue

p 63

CURRENT EVENTS

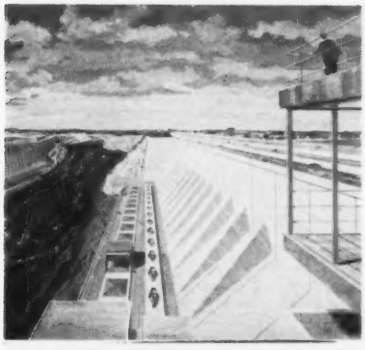
"Total-Electric Home" Program to Push Heat

Westinghouse's $2.5 million promotion program will emphasize use of electricity for home heating and cooling....p 32

Which Is Cheaper–Electric or Gas?

EEI report says sound choice between all-electric and combination service requires detailed economic analysis...p 63

p 34



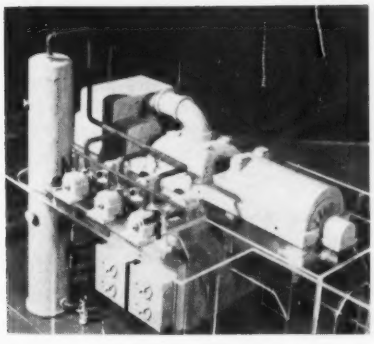
DISTRIBUTION

Single-Phase Cheaper for Home Cooling

Bryce Brady, Bela B. Mohr, Emil F. Buettner, Oklahoma G&E

Installed cost to customer, distribution system outlays favor it over 3-phase for 5-ton home cooling units.....p 38

p 42



GENERATION

Niagara Power Project to Cost $705 Million

John Saloma, Charles T. Main, Inc

State Authority's scheme, including 2,190-Mw Lewiston Station, largest in hemisphere, to be ready in 1962.....p 34

Single Shell Combines Feedwater Heaters

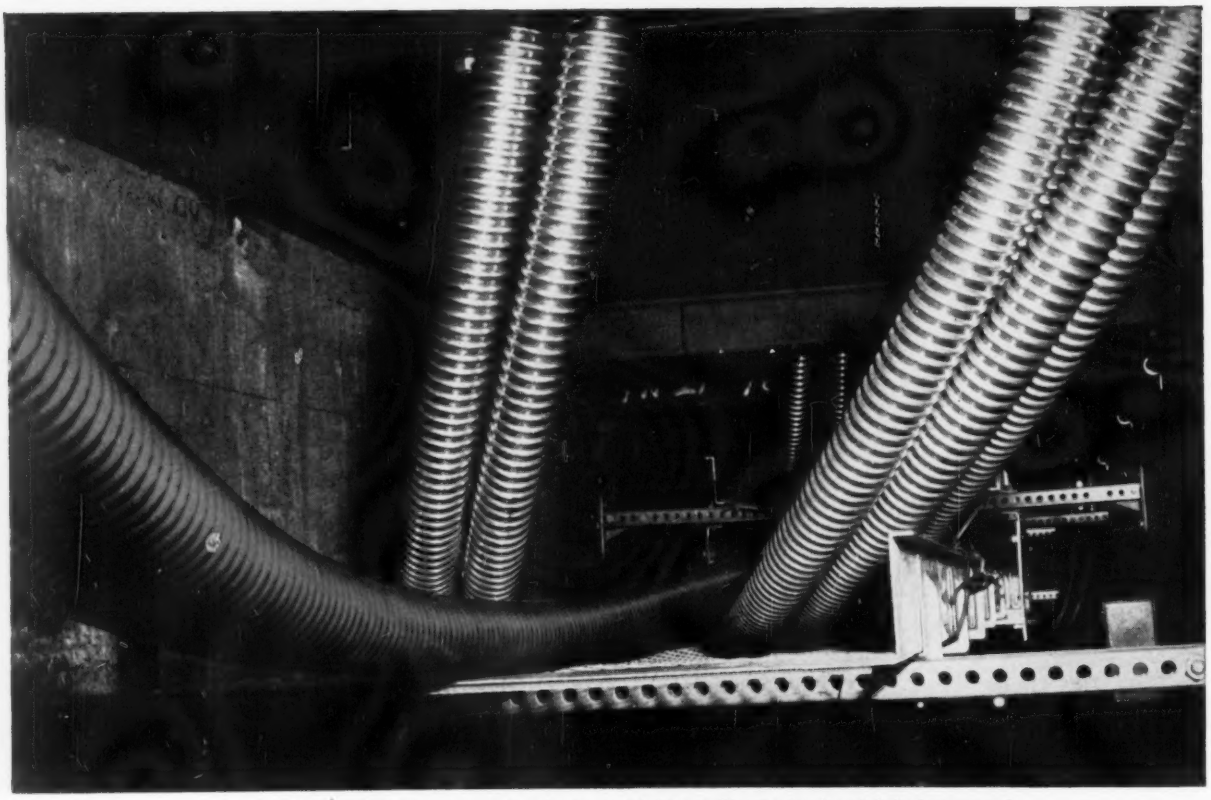
Frank P. Witmer, Jr, Kuljian Corp

"K" Heater, a regenerative system, brings nearer the promise of power production at lower cost.....p 42

Departments

Editorials 27
Electric Utility Methods..... 40
• Electrical Week 11
Executive Reader 14
From the Publisher..... 5
• Management Newsletter ... 63
Manufacturers News 48
Meetings Calendar 82
New Equipment 56
News About People..... 72
Politics and Public Power... 12
Readers Service 60

INDEX TO ADVERTISERS... 82



Quick identification for high voltage primaries is provided by an Okonite-developed, baked-on enamel finish in bright orange. In this access tunnel below transformer enclosure 3/c 15kv Okonex primaries are laid in same tray with 3/c 600v Okonex secondaries with plain aluminum Loxarmor. Plant and electrical system were engineered and designed by Southwestern Engineering Company. Electrical contractors were Trowbridge & Flynn Electric Company.

"Power supply is vital," said Diamond Gardner Corp. "We furnished Okonite cables," said Del E. Webb and SWECO

Here was an ultra-modern, completely integrated manufacturing operation where power failures could trigger a costly "chain reaction" in down time. That's one reason why Del E. Webb Construction Company and Southwestern Engineering Company furnished Okonite cables for extensive use in the new and unique mechanical pulping mill for Diamond Gardner Corporation's Integrated Forest Products Center at Red Bluff, California.

Another reason was SWECO's knowledge that The Okonite Company, because it alone makes cables by all methods, is uniquely qualified to help select the best cable for a specific circuit . . . and manufacture it to suit any installation conditions.

All primary and secondary power and control circuits in the plant are Okonite cables. For example: lightweight Okonex-insulated Loxarmor primaries, identified by an Okonite-developed bright orange, baked-on enamel finish, carry all power at 12kv to the twin transformer vaults in the plant. 600-volt Watertite-Loxarmor, 600-volt Okonex-Loxarmor and 5kv Okonex-Loxarmor, in racks, were selected for secondary distribution for their flexibility, low installation costs and the ease with which circuits can be added or re-routed. 600-volt Okotherm control cables were specified for circuits where high heat conditions are encountered.

Okonite quality . . . Okonite's ability to build cables by any method . . . and Okonite's expert design and installation assistance are factors to consider when ordering or specifying cables for your important installations. For more data on Loxarmor, write for free, 36-page Bulletin EW-1090, The Okonite Company, Passaic, New Jersey.

where there's electrical power . . . there's **OKONITE CABLE**

6215

More Cost-Saving Ideas

Most of you will recognize the "Electric Utility Methods" section (pages 40, 41) of this issue as the old, familiar "How To . . ." section. It is a sharply edited selection of cost- and labor-saving ideas written particularly for readers responsible for the design, construction, operation, and maintenance of utility facilities.

The new title was chosen partly because we believe it is more descriptive of the actual content of the section. But more importantly, we have adopted the new title to hail our expanded service in these areas during 1959.

In addition to the regular weekly sections, which totalled more than 100 pages in 1958, we are now planning quarterly special reports on "Electric Utility Methods" during 1959. These will be included in Electrical World issues of March 30, June 29, September 28, and December 21.

They will be patterned after the 72-page report in the December 22, 1958 issue.

Expanded coverage in the fields of construction, operation, and maintenance is our attempt to help meet the constant demand for economies as labor and material costs continue to climb.

Fischer Black

Electrical World Staff

Fischer Black Publisher and Editor

Daniel T Braymer Senior Editor

Engineering

Leonard M Olmsted Managing Technical Editor
Howard S Knowlton New England Editor, Boston
Edward Allen Midwestern Editor, Chicago
Francis J Kovalcik Middle Eastern Editor
Charles F Hochgesang Western Editor, San Francisco
Rue M Shoop Associate Editor
James G Plunkett Associate Editor
George Swift Associate Editor
Kenneth N McLean Northeastern and Industrial Editor
Leon A Allen, Jr Assistant Editor
Archer E Knowlton Consulting Editor

News

Herbert R Frankel Managing News Editor
Thomas R Jordan Assistant Managing News Editor
Theodore Fuller News Editor
Michael G Duerr Assistant News Editor
John D Damon Commercial Editor
George B Bryant, Jr Manager, Washington Bureau

Special Services

Arthur J Stegeman Manager, Market Research
Dexter M Keezer Director, Economics Department
E Russell Eggers Economist

Production

Jesse A Mock Manager of Production
Frank C Stockman Art Director
H Tomlinson Howland, Jr Associate Art Director
Donald J Sullivan Assistant Production Editor

Advertising

Warren W Shew Sales Manager
District Managers: W R Klein, L R Lawrence, D J Roberts, New York; L R Lawrence, Boston; F P Coyle, Philadelphia; M S Kearney, E F Coffey, Jr, Cleveland; E F Coffey, Jr, Detroit; M S Kearney, Pittsburgh; W H Meneilley and J T Schaefer, Chicago; J T Schaefer, St. Louis; Russell Antles, Los Angeles; R C Alcorn and T H Carmody, San Francisco; Robert H Powell, Atlanta; Gordon Jones, Dallas; John Patten, Denver.
Otto A Drechsel Business Manager
John F Dugan Assistant Business Manager
Donald K Ellis Promotion Manager

E Bryson Sessions Circulation and Sales Service Manager

ELECTRICAL WORLD

Vol. 151, No. 3, Jan. 19, 1959

Published weekly by McGraw-Hill Publishing Co., Inc., James H. McGraw (1860-1948), Founder. **Executive, Editorial, Circulation and Advertising Offices:** McGraw-Hill Building, 330 West 42nd Street, New York 36, N. Y. Printed at 99-129 North Broadway, Albany 1, N. Y. See panel at right for information regarding subscriptions or change of address.

Donald C. McGraw, President; Joseph A. Gerardi, Executive Vice-President; L. Keith Goodrich, Vice-President and Treasurer; John J. Cooke, Secretary; Nelson Bond, President, Publications Division; Shelton Fisher, Senior Vice-President; Ralph B. Smith, Vice-President and Editorial Director; Joseph H. Allen, Vice-President and Director of Advertising Sales; A. R. Venezian, Vice-President and Circulation Coordinator.

Subscriptions are solicited from executive, supervisory, and engineering personnel in electric utilities, manufacturing companies, and related fields; and from consulting engineers and electrical engineers in industry. Position and company connection must be indicated on subscription orders. Send to address shown in box at right.

United States and Canada subscription rate for individuals in the field of the publication $6.00 per year; single copies 50 cents. Other Western Hemisphere and the Philippines $20.00 payable in advance and other countries $30.00 payable in advance.

Second-class postage paid at Albany N. Y. Title registered in U. S. Patent Office.

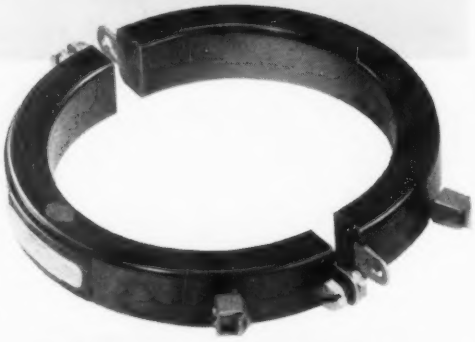
©Copyright 1959 McGraw-Hill Publishing Company, Inc. All rights reserved. Permission required to reproduce any of contents. Printed in U.S.A.

SUBSCRIPTION AND ADDRESS CHANGES: Send subscription correspondence and change of address to Fulfillment Manager, ELECTRICAL WORLD, 330 West 42nd Street, New York 36, N. Y. Subscribers should notify Fulfillment Manager promptly of any change of address, giving old as well as new address, and including postal zone number, if any. If possible, enclose an address label from a recent issue of the magazine. Please allow one month for change to become effective.

Postmaster . . . Please send form 3579 to Electrical World, 330 W. 42nd St., New York 36, N. Y.

DEVELOPED TO MEET YOUR NEEDS:

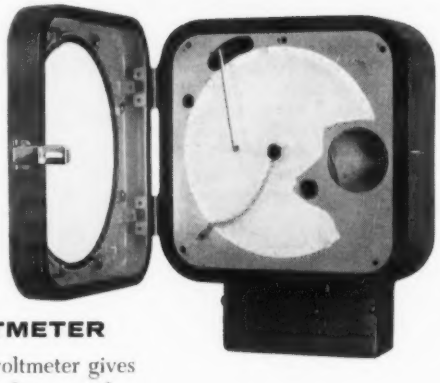
New Lincoln Meters
FOR SYSTEM MEASUREMENT



For simple low-cost network system load measurement

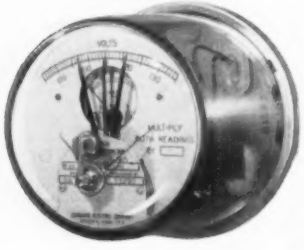
Developed for survey information on underground networks, new split-core transformers and a submersible Lincoln graphic ammeter provide unusual flexibility.

Indicating ammeter can be permanently mounted outside vault using new split-core transformers located on network protector bushings.



SYNCHRONOUS-CARRYOVER GRAPHIC METER

Sangamo designed this graphic meter to keep the chart turning during power interruptions. The carryover-drive mechanism maintains timing for outages up to 14 hours and also provides a record of the number and time of outages.

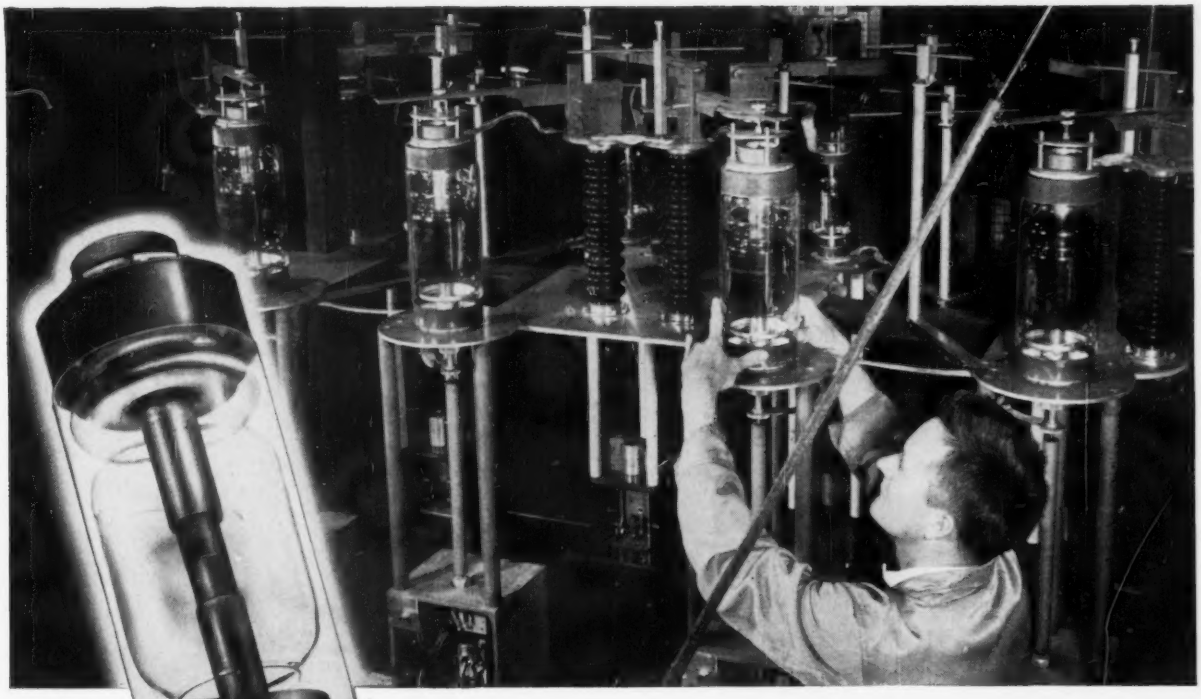


LINCOLN INDICATING VOLTMETER

A newly designed model of the Lincoln voltmeter gives "steady state" maximum and minimum voltages and instantaneous readings for immediate indication as to whether the circuit is energized.

SM 59-1

SANGAMO Electric Company
SPRINGFIELD, ILLINOIS



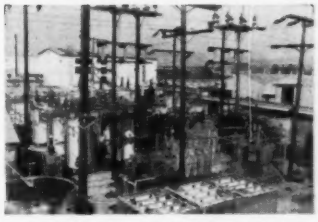
Here's why VACUUM POWER SWITCHES provide positive, unfailing operation — *every time*

Since vacuum switches represent a distinctively new approach to power switching we feel a responsibility to provide the utmost certainty of operation to each switch leaving our plant. To accomplish this each Jennings Vacuum Power Switch is tested more than 100 times at full rated voltage and load current. In addition, continual life tests are being conducted up to the full capabilities of each switch using capacitive, inductive, and resistive loads.

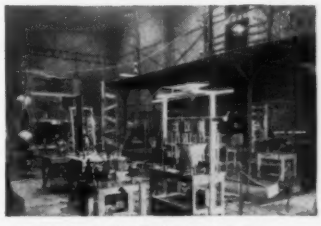
In order to make these tests possible and to insure perfect operation of every switch, Jennings has gone to unusual lengths to provide more than adequate testing and research facilities.

As an example, Jennings High Voltage Lab has 680,000 kva available with over 6500 amperes at 60 kv for short circuit testing. Up to 2500 short circuit amperes can be developed at 120 kv and surge current tests of 200,000 amperes can be run at low voltage. Since our vacuum power switches are particularly effective in switching capacitors, the equivalent of 20,000 kva of capacitors at voltages up to 230 kv is available for testing. Our vacuum switches can also be tested with 30,000 kva of pure inductive load at voltages up to 115 kv.

Vacuum power switches have inherent advantages that allow them to perform many difficult tasks that cannot be performed by conventional switchgear, but reliability remains its foremost quality. Jennings unusually complete testing facilities and a record of hundreds of successful vacuum switch installations in the power field are your insurance that the vacuum switch is more than capable of performing the function at which it is rated.



Substation and high voltage laboratory at Jennings Manufacturing Corporation



Interior of high voltage laboratory

We have prepared literature describing the ten sizes now available for power use. Send for your copy.

JENNINGS RADIO MANUFACTURING CORPORATION • 970 McLAUGHLIN AVE., P. O. BOX 1278 • SAN JOSE 8, CALIFORNIA

Jennings®

A NEW WRINKLE IN NETWORK DESIGN

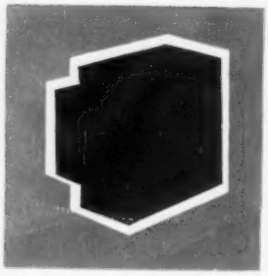
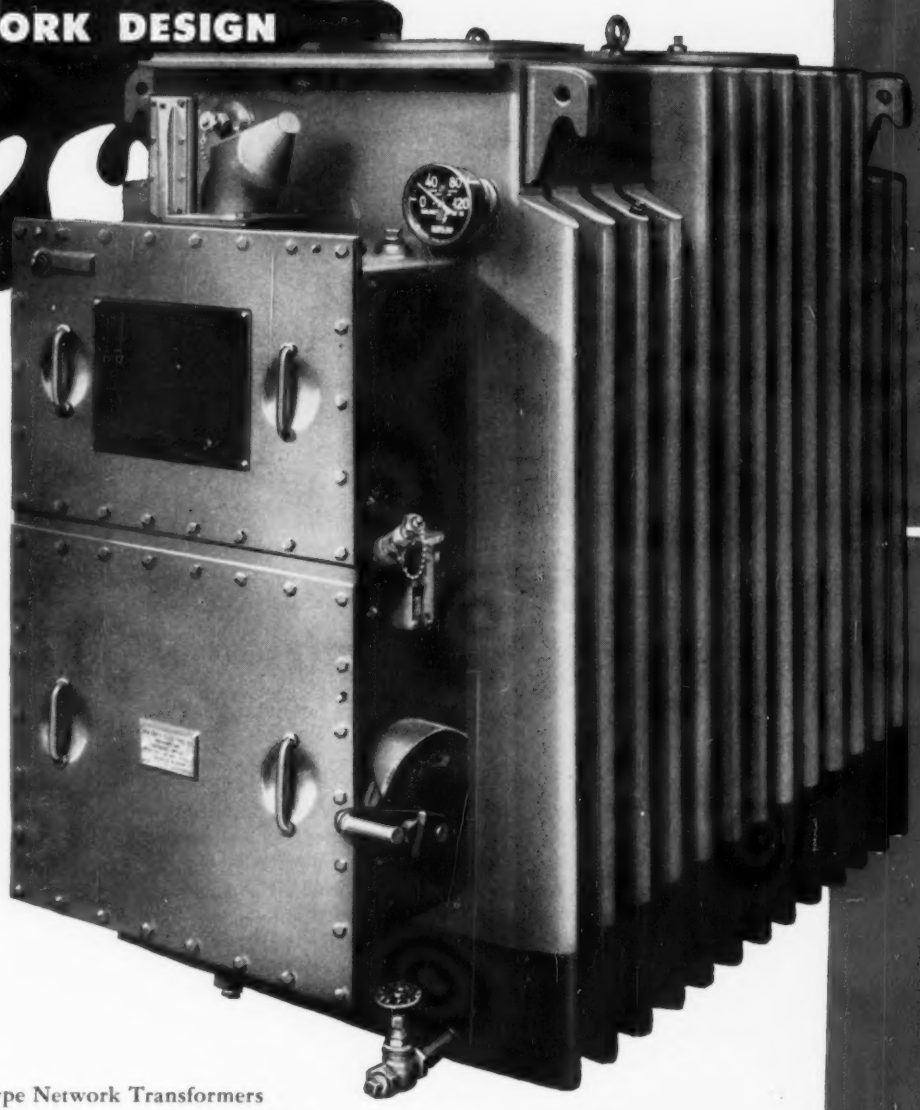


Diagram illustrates savings in space of new design as compared with older type network transformer.



Moloney Subway or Vault-Type Network Transformers with corrugated tanks are strong, rugged units developed by Moloney to answer some of the problems associated with the use of network transformers.

These units are built to conform to the EEI-NEMA Standards for Network Transformers or to conform to customers specifications.

Moloney Network Transformers offer your system the performance, dependability and trouble-free service expected of all Moloney products . . .
Specify Moloney Transformers for Quality . . . All Along The Line.

ME58-13

MOLONEY ELECTRIC COMPANY

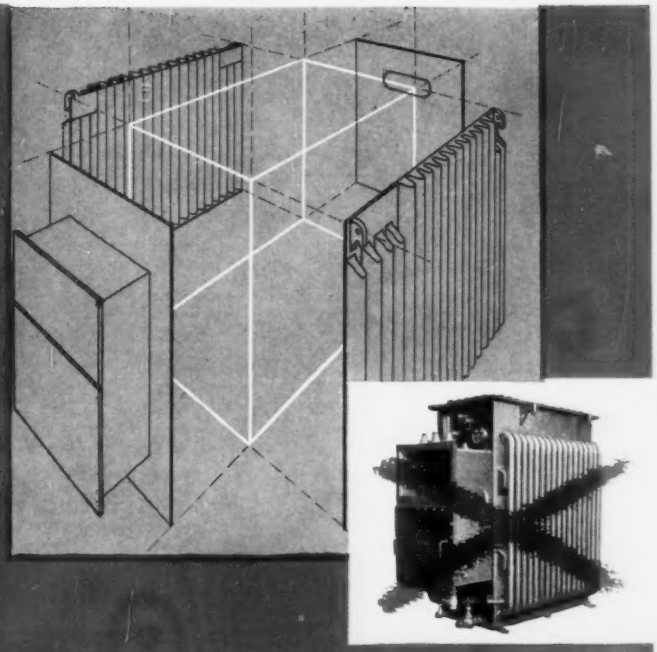
Manufacturers of Transformers for Utilities, Industry, and Electronic Applications

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA

REAL TANK CORRUGATIONS

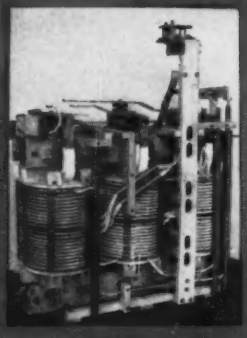
Moloney Network Transformer tank walls are really corrugated (as shown in diagram) and are welded only at the corners.

The old problems of corrosion spots and servicing accessibility are gone; now inspection, cleaning and painting is easily done from above.



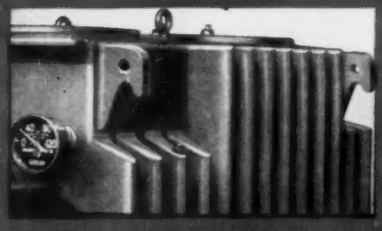
RUGGED CORE-AND-COIL UNIT

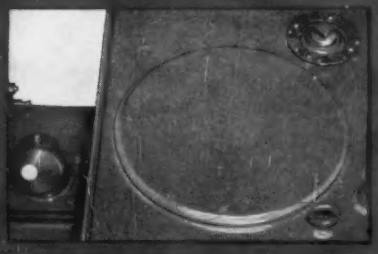
The core-and-coil assembly is a rugged, compact unit solidly blocked and framed. Every load is adequately insulated and rigidly braced. All bus bars are supported by stand-off insulators. The core-and-coil unit is securely fastened into its position in the tank by adjustable clamps.



INCREASED MECHANICAL STRENGTH

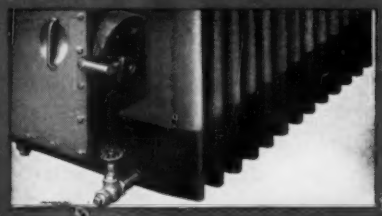
Moloney's ability to corrugate the steel plates of the transformer tank wall produces a tank of inherently greater mechanical strength, thereby eliminating the need for cross bracing.





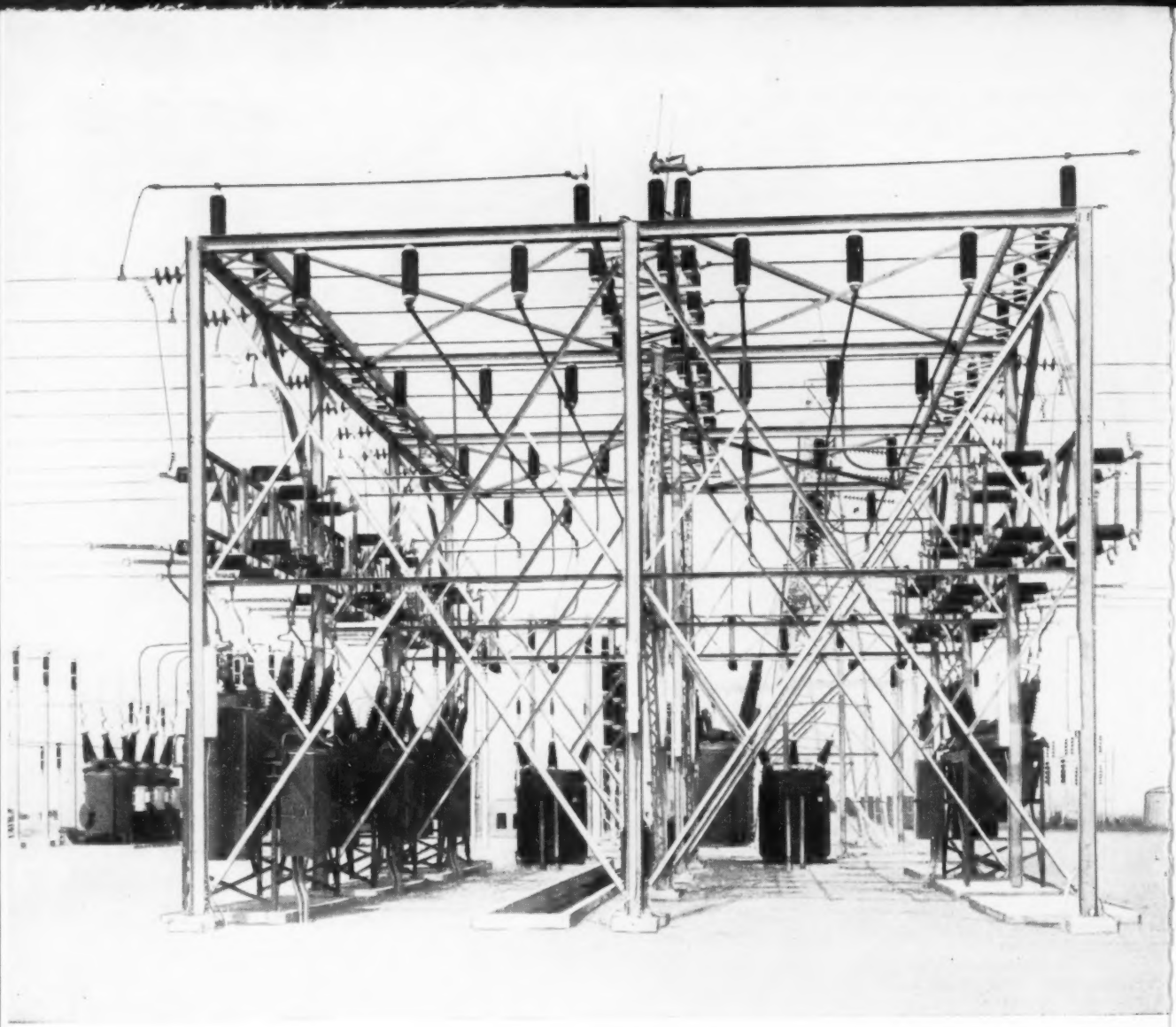
SEALED AGAINST MOISTURE

Tank seams and connections are welded or absolutely sealing the tank against the entrance of moisture.



UNDERCOATING OF TANK BASE AND LOWER TANK WALLS

Maximum protection against rust and corrosion is obtained by the application of protective undercoating extending up the tank walls to a point above the normal level of submersion.



SINGLE-SOURCE SUBSTATION PACKAGE

assures totally-integrated, economical installations

Speeding installation...saving you time and trouble...assuring top quality construction throughout – Federal Pacific stands ready to meet *all* your switchgear requirements in a single operation. The advantage: one order, one equipment manufacturer, unified control.

From initial engineering service to the completed installation–one plan guides the entire project to simplify purchasing, provide more accurate cost control and eliminate unexpected "hidden costs". And more important, when you buy the complete package from Federal Pacific you are assured a completely integrated installation. Each component is engineered to insure trouble-free, smoothly integrated operation.

With more than 50 years of experience in this field...with installations throughout the world...with a steady flow of repeat orders indicating satisfied acceptance–Federal Pacific is equipped to meet all your switchgear needs from beginning to end. Federal Pacific Electric Co., 50 Paris Street, Newark 1, N. J.

FEDERAL FPE PACIFIC

Better Products to Control Electricity

The Electrical Week

FUTURE NEWS ▶ **Look for a formal policy statement on civilian atomic power use** during the coming year.

LATE NEWS ▶ **Cuba's Fidel Castro reverses his stand on utility nationalization,** says he will not nationalize foreign-owned utilities, but damage suffered by them will "have to be collected from Batista."

YPF-10, a floating power plant, is being towed from Jacksonville, Fla., to Hoboken, N. J., for transfer to outlying government base.

Houston L&P yanks 6,500 demand meters in policy shift. Company has set new standards as a basis for installing them.

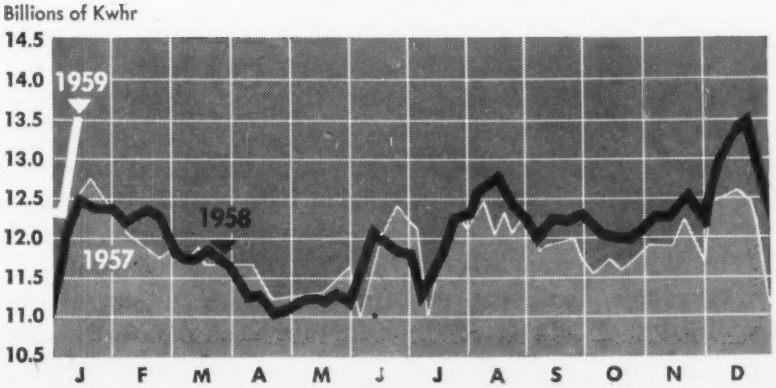
About TVA . . . Rainfall in area during 1958 was six in. below average, and runoff since September is fifth lowest in 85 years . . . Chamber of Commerce TVA resolution branded by 41 in the House as "impractical, unfair, and unsound" . . . Senators from four southern states agree to push self-financing through revenue bonds.

Notes on the Northwest . . . A bill will soon be introduced in the Wyoming legislature which will exempt municipally-owned electric plants from state property taxes. Recently 12 municipalities lost a battle in the Wyoming Supreme Court to escape this tax . . . FPC gives a 50-yr license to Eugene, Ore., Water & Electric Board to build the three-dam "Carmen-Smith" project on the McKenzie and Smither Rivers.

Nebraska legislature gets bill to prohibit PPD's from spending money for political purposes. Sen T. Carpenter introduced it.

Iowa P&L and Iowa-Illinois G&E abandon merger talks. A joint statement concluded that the merger "cannot be consumated at this time."

POWER OUTPUT—UP 8.4% (Week ending Jan. 10), Kwhr 13,554,000,000



Per Cent Change From Previous Year

	Dec. 27	Jan. 3	Jan. 10
Total U. S. ..	+10.3	+5.7	+8.4
New Eng.	+12.1	+8.9	+12.0
Mid. Atlantic .	+9.9	+5.1	+7.1
Cent. Ind.	+11.9	+8.2	+9.9
West Cent. ..	+12.2	+6.8	+11.5
Southeast	+10.0	+1.6	+4.6
South Cent. ..	+9.6	+8.3	+11.4
Rocky Mount..	+7.8	+6.3	+9.0
Pacific			
NW	+8.3	+3.4	+10.6
SW	+8.5	+8.6	+8.0

Seasonally Adjusted Index 248.4

Week Ago 239.9 Year Ago 229.6

Source: Edison Electric Institute

Preview of this Issue

EVENTS ▶ **A double standard of regulatory jurisdiction** over co-ops and power companies has been imposed on the Indiana Public Service Commission. An Appellate Court ruling nullified the PSC's order of last March, which required approval of federal loans to the co-ops. This order was based on a state Supreme Court definition of the co-ops as "public utilities" **(p 28)** . . . More than 2,000 bills were introduced in the House and 176 in the Senate the first day of the 86th Congress. A roundup of bills of interest to electric utilities begins on **p 29** . . . An AEC advisory committee, appointed by Chairman John McCone, has come up with some A-power recommendations that may bridge the gap between conflicting views of the Atomic Energy Commission and Democratic champions of an expanded program **(p 30)** . . . Westinghouse announces: (1) A 5-Mw pressurized-water reactor for General Public Utilities **(p 30)**; and (2) A $2.5-million "Total Electric Home" promotion in which the all-electric living idea is keyed to electric heating and cooling **(p 32)**.

ENGINEERING ▶ **Niagara hydro project will cost New York $705 million.** It will include 2,190-Mw Lewiston Station, largest hydro plant in the hemisphere. It will be ready in '62 **(p 34)** . . . Single-phase serves air conditioning better and cheaper **(p 38)** . . . A new type regenerative feedwater

Politics and Public Power

The principal bone of contention to be decided by the full Federal Power Commission in the ECAP case is whether the Electric Companies Advertising Program is directed primarily toward an "area of political controversy", as maintained by FPC Staff Counsel Leonard Eesley, or is a reasonable business expense designed to meet competition—in this case from the government—as maintained by A. J. G. Priest, principal counsel for the 59 defendant utilities.

In last week's story on the first hearing (EW, Jan. 12, 1959, p 49), it was stated that "Priest appeared willing to admit that the nine ads in question were politically controversial." Actually, Priest did appear willing to make such a statement, but he emphasized that such an admission would be immaterial if his interpretation of the issues was upheld. This interpretation is summarized by the testimony he plans to present:

- The federal government is the largest producer of power in the U. S., with $10 billion when present projects are completed. These federal projects involve only "proprietary" functions of government, and are clearly in competition with private enterprise.
- The real cost difference between public and private power would be negligible, if all costs were included in each.
- All federal power is subsidized through either lower interest rates; omission or reduction of taxes; manipulation of cost allocations to multi-purpose projects; charging administrative costs to other government accounts; or below-tariff railroad rates for hauling coal.
- Federal agencies have actively promoted power distribution by rural co-ops and municipals. Federal preference clauses have been used to push federal power, and denial of preference rates to utilities have caused their customers to pay higher rates than federal

heating system has been developed by a Philadelphia firm **(p 42)**.

MANAGEMENT ▶ **Electric vs gas service: What's best for military housing?** There's no "pat" answer, says Gilbert Associates in a new study done for EEI. It takes detailed economic analysis of each individual project. The study shows how to make such an analysis, concludes that there's a place for the all-electric home in military multiple housing projects in many areas of the U. S. **(p 63)**.

MANUFACTURERS ▶ **All-aluminum transformer is on the way (p 42)** . . . Westinghouse expands its "Power Up" program for '59 **(p 51)**.

NEW EQUIPMENT ▶ **Service area becomes integral part of switchgear structure** . . . Power transformers feature rectangular sealed tanks with compact round cooling tubes . . . Diesel generators are available in eight models from 50 to 200 kw **(p 56)**.

PEOPLE ▶ **South Carolina Electric & Gas names F. R. McMeekin to board** of directors and executive committee. J. F. Radar becomes vice president and chief engineer. A. M. Williams and A. C. Mustard are other new vice presidents **(p 72)**.

customers. Federal power "yardsticks" tend to deceive private customers and investors, and the nine ECAP ads were aimed at countering this deception.

- All investor-owned companies are threatened by government power activities; ECAP ads are intended to answer the villification of private companies by government power advocates. Also, the ads have tended to counteract the advertising and publicity of these advocates.
- Government power is competitive with utilities in many ways. It is a basic obligation of utilities to meet this competition. Advertising is an accepted means of meeting it, and nothing is changed by the fact that the government happens to be the competitor.
- The ads in question, like all such advertising, are in the interest of the companies and their customers because they instill confidence in investors.
- Accountants have long considered the cost of advertising and publicity as a necessary business expense. There is no basis to distinguish between ads on the type of competition they are intended to combat; the ECAP advertisements were properly accounted for in Federal Power Commission categories 787 and 801.
- The FPC did not challenge the accounting procedures for ECAP contributions between 1941 and 1957. The complaint was clearly made by members of the U. S. Senate, the National Rural Electric Cooperative Assn, and "perhaps others."
- Reclassification of the expenditures to a "below the line" category, such as No. 538, would constitute a present damage; and if the Uniform System of Accounts is interpreted to require that they be placed in 538, such accounts are to such extent invalid and unenforceable.

The solution to future power generation problems, such as a 16 million-kw plant on a mile-square site, lies not in doing better what we already know how to do but in proving the technical and economic feasibility of new ways and means. **A Look at the Future in Power Station Design, E. H. Krieg, Mechanical Engineering, November, 1958.**

Low cost industrial gas is essential if the people who grow up in this area are to remain and work here. Our interest is in the overall development of the area we serve with electricity. If we can serve gas, particularly industrial gas, at a lower cost, we will advance the day when we can do a much larger industrial business. **Why Water Power Took On Gas, Kinsey M. Robinson, Electrical West, December, 1958.**

TECHNICAL NOTES

Increasing the pressure of nitrogen during breakdown tests produces a near-linear rise in sparkover potential at the larger electrode spacings in a 0.001-0.025-in. range. At the lower spacings, voltage approaches a limiting value despite pressure increases.

Corona effect of a two-conductor bundle is influenced by bundle spacing but not by horizontal or vertical placement of the conductors.

Fly ashes not meeting the requirements of ASTM specifications C350-57T nonetheless have been used successfully as an admixture in Portland cement concrete.

Physical and mental health is related to the ion content of the air. Excess positive ions slow healing, cause mental depression, and aggravate arthritic conditions. Excess negative ions relieve these conditions and promote a general state of well being.

FROM EDITORS IN THE FIELD

Collapsible rubber container of 5,000-gal capacity stores oil from transformers or circuit breakers during maintenance on the Ontario Hydro-Electric Power system. The 385-lb container folds into a compact package.

Allowance for 10 years of creep was designed into a 115-kv line bundled with a new conductor above the old by a large southeastern utility. From an initial spacing of 9 in. at suspensions and 2 ft 9 in. at midspan, the new conductor will creep to a uniform 9-in. spacing.

Harder to poke a hole in...

Why make a bushing's oil reservoir in the form of a heavy bronze casting? Isn't it wasteful? After building bushings this way for 50 years, maybe we just can't break with tradition.

Granted, 50 years' experience has a lot to do with it. On rare occasions, the reservoir may serve a special purpose. In the event of flashover, it is one terminal of a blazing power arc. This can burn a hole in a flimsy part, and the bushing is lost. Heavy cast bronze is the best insurance against such damage we know of. The small extra cost involved is simply an investment in maximum safety and service.

One of the intangibles you buy in modern O-B condenser bushings is mature knowledge of the business. This shows-up in all kinds of ways and places. It's "the extra value in the package."

Manufacturers of transformers and circuit breakers are glad to supply the bushing of your choice, *when you express that choice.* Make a point of asking for O-B bushings. It's very well worth the slight extra attention.

OHIO BRASS COMPANY, MANSFIELD, OHIO

Ohio Brass (B)

HOLAN

PORCELAIN INSULATORS · LINE HARDWARE · CAPACITORS · LIGHTNING ARRESTERS · BUSHINGS · HOLAN TRUCK MOUNTED POWER DEVICES AND BODIES · BRONZE VALVES

Thorex A

Same high-performance Dynagap element used in all classes and voltage ratings.

Up-grades protection of lighter-duty types.

Drastically reduces size of station models.

Arresters break the "class barrier"!

Revolutionary Dynagap Element Interchangeable In All Voltage Ratings From 1 to 345 kv

Entirely new in the lightning arrester art is a protective element interchangeable in all grades and all voltage ratings. This is the Dynagap!

Adaptable to a new miniaturized line of Distribution Class arresters, this same element imparts drastic size reduction when applied to heavier-duty types. Station Class Thorex arresters are now no larger than insulator stacks - - one-third the height of former types, a fraction of the weight, and devoid of unit connections by virtue of continuous porcelain housings. This provides a practical remedy to contamination problems.

Distribution and Intermediate Class Thorex arresters enjoy the unheard-of advantage of sharing the same high-performance elements as used in models for service up to 345 kv.

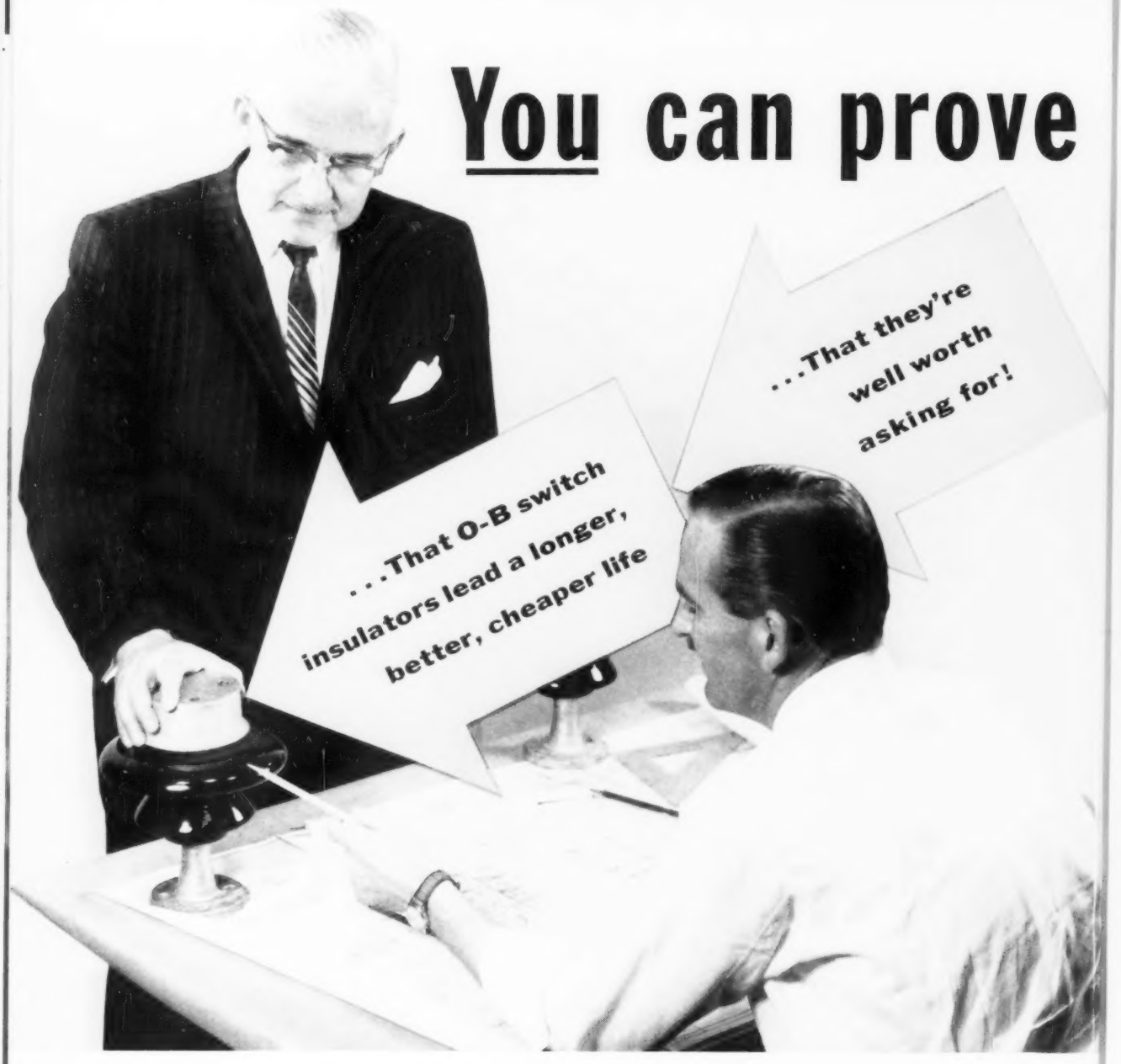
Before your next lightning arrester requirements are placed - - Distribution, Intermediate, or Station Class - - give Thorex your most critical examination. From any standpoint, including cost, it is today's distinct choice.

OHIO BRASS COMPANY, MANSFIELD, OHIO

Ohio Brass ® HOLAN

PORCELAIN INSULATORS · LINE HARDWARE · CAPACITORS · LIGHTNING ARRESTERS
BUSHINGS · HOLAN TRUCK-MOUNTED POWER DEVICES AND BODIES · BRONZE VALVES

You can prove



Standards *don't say* all switch insulators are alike -- neither does your experience. Some live longer than others, and give "better mileage" on your investment. Some have a history of little or no trouble; little or no maintenance expense.

Which ones? Look at your own records.

In your own files -- maybe your own handwriting -- and stated in your own terms, are facts that should contain an interesting story. You can see what insulators were installed, when, and the subsequent replacement record, and if your findings are typical, O-B will show a distinct advantage. Remember, this isn't *our* story, it's *yours!*

Switch manufacturers will gladly supply any make of insulator you choose. You need only *make that preference known.* By the simple act of asking for O-B insulators on your new switches, you will continue getting a bonus in performance that your own operating facts can prove is true.

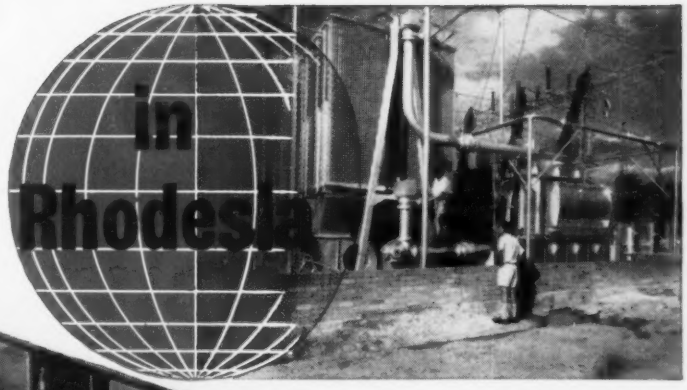
OHIO BRASS COMPANY, MANSFIELD, OHIO
Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont.

Ohio Brass (B)

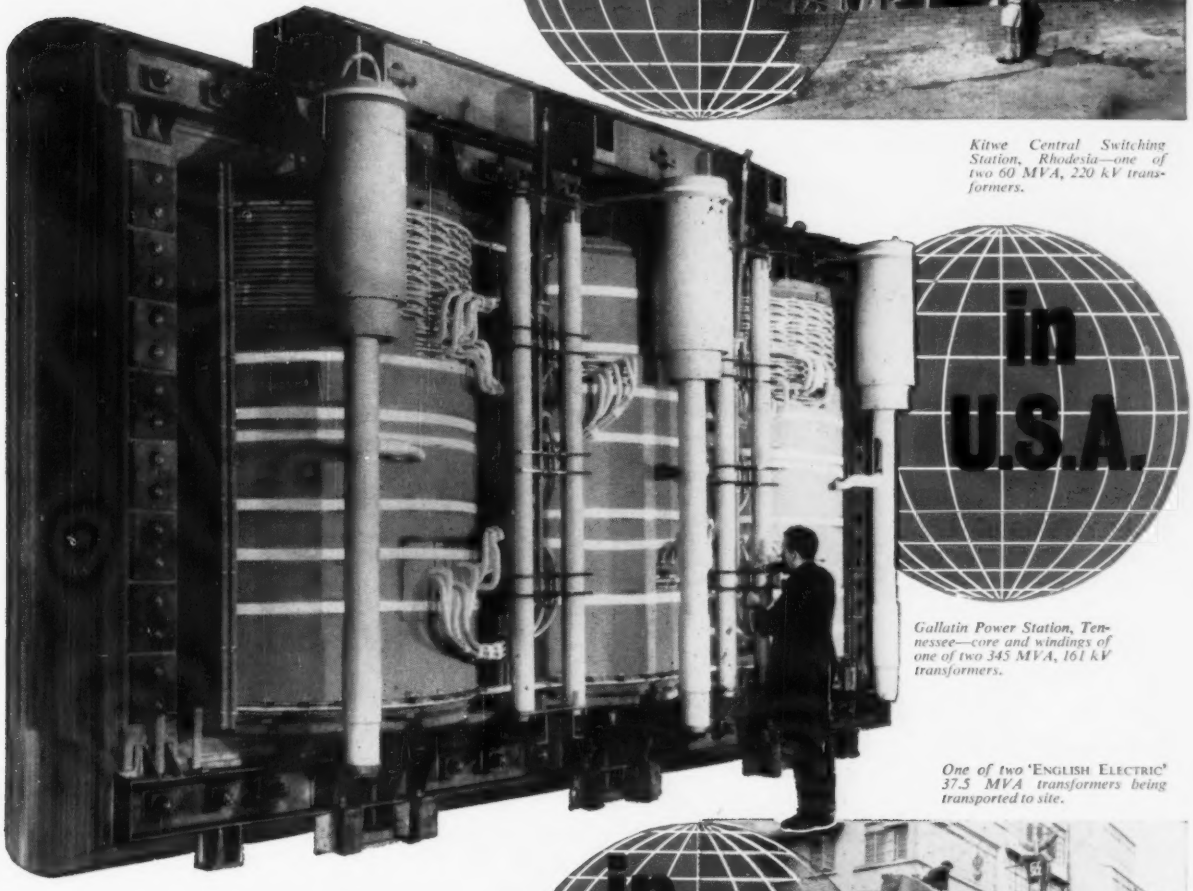
HOLAN

PORCELAIN INSULATORS · LINE HARDWARE · CAPACITORS · LIGHTNING ARRESTERS
BUSHINGS · HOLAN TRUCK MOUNTED POWER DEVICES AND BODIES · BRONZE VALVES

Transforming the WORLD'S POWER

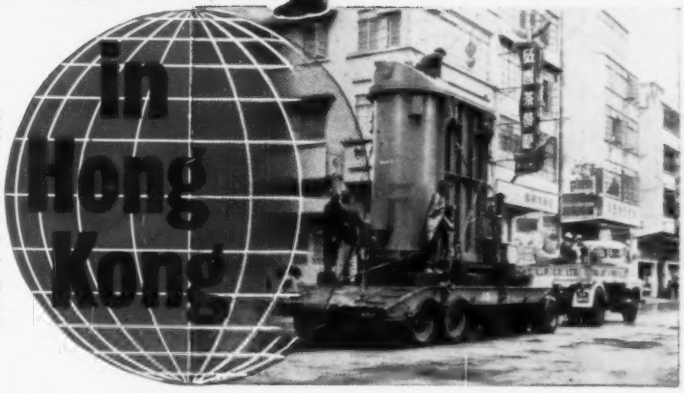


Kitwe Central Switching Station, Rhodesia—one of two 60 MVA, 220 kV transformers.



Gallatin Power Station, Tennessee—core and windings of one of two 345 MVA, 161 kV transformers.

One of two 'ENGLISH ELECTRIC' 37.5 MVA transformers being transported to site.



'ENGLISH ELECTRIC' transformers are in service throughout the world and can be supplied for voltages up to the highest envisaged and for outputs up to the largest practicable.

Two of the largest transformers in the world—345 MVA, 22.5/161 kV, 3-phase, 60 cycles—have been supplied by 'ENGLISH ELECTRIC' to a T.V.A. power station in Tennessee. Contracts have been completed and are in course of manufacture for many other major American power projects.

'ENGLISH ELECTRIC' products cover all aspects of the generation, transmission and utilization of electric power. Service facilities are available through three large Canadian plants.

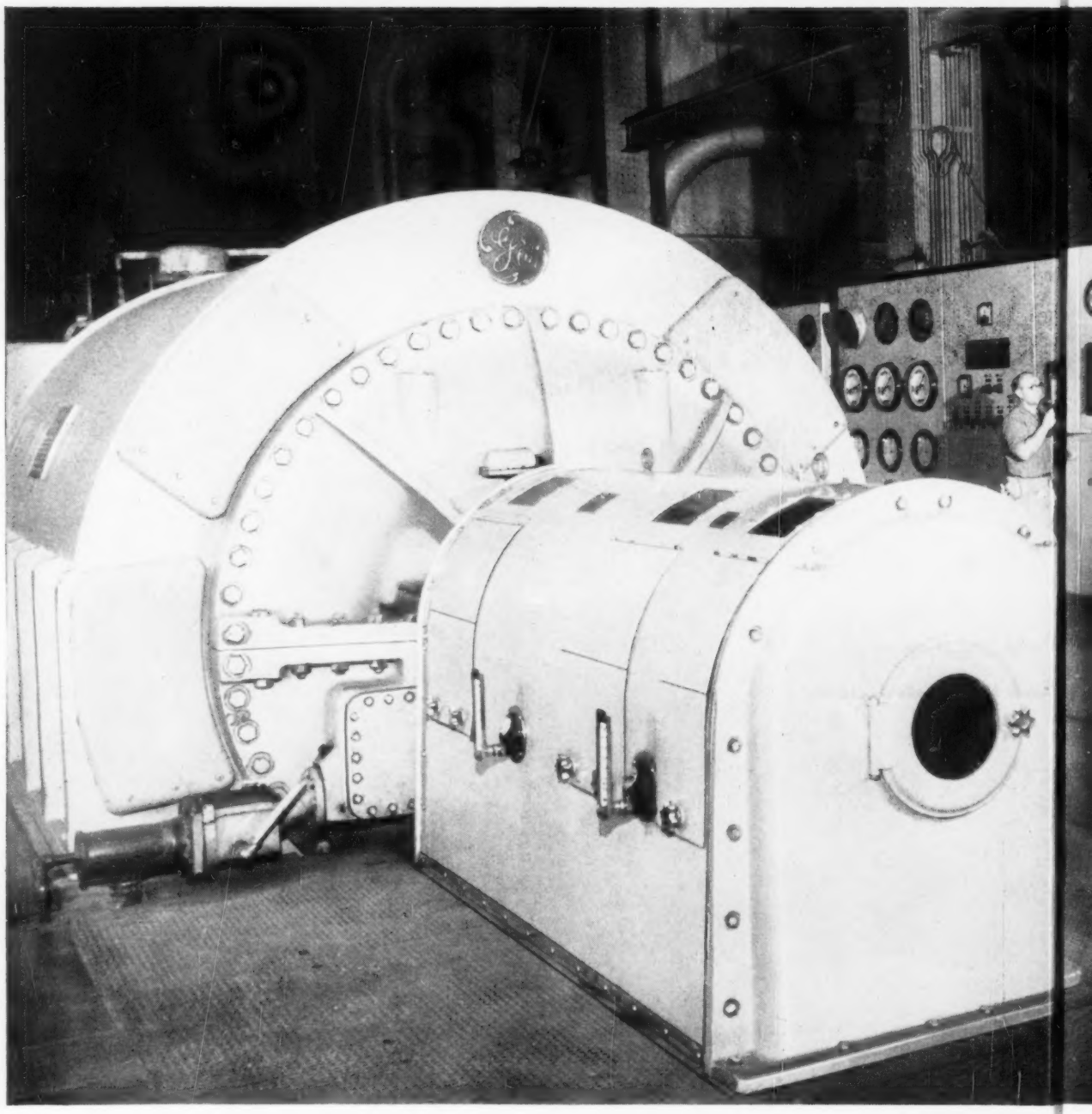
'ENGLISH ELECTRIC'

Agents for Washington, Oregon, Montana, Idaho, Wyoming, Nebraska, California, Arizona, Utah, Nevada and the Alaska territory: **James I. Metcalf & Co. Inc.**, 701 United Pacific Building, Seattle 4, Washington. Branch offices in San Francisco, Los Angeles, Portland, Phoenix. Agents for Georgia, Alabama, Tennessee, South Carolina, Florida and Kentucky: **Osgood & Associates, Inc.**, 988 Spring St. N.W., P.O. Box 7383, Station C, Atlanta 9, Ga. Branch office in Birmingham, Ala. Agents for Louisiana and Mississippi: **Electron Equipment Co. Inc.**, 1050 Constance St., New Orleans, 13, La. Agents for Texas, Oklahoma, Arkansas and New Mexico: **Peabody Bros.**, 2903 St. Louis St. at Oakland, Dallas 26, Texas. Branch offices in Houston and Tulsa.

Enquiries for territories not covered by Agents should be directed to:

ENGLISH ELECTRIC EXPORT & TRADING CO. LTD., 23/25 BEAVER STREET, NEW YORK 4, N.Y.

OC/US/1



No downtime due to oil failure in 17 years! More proof that

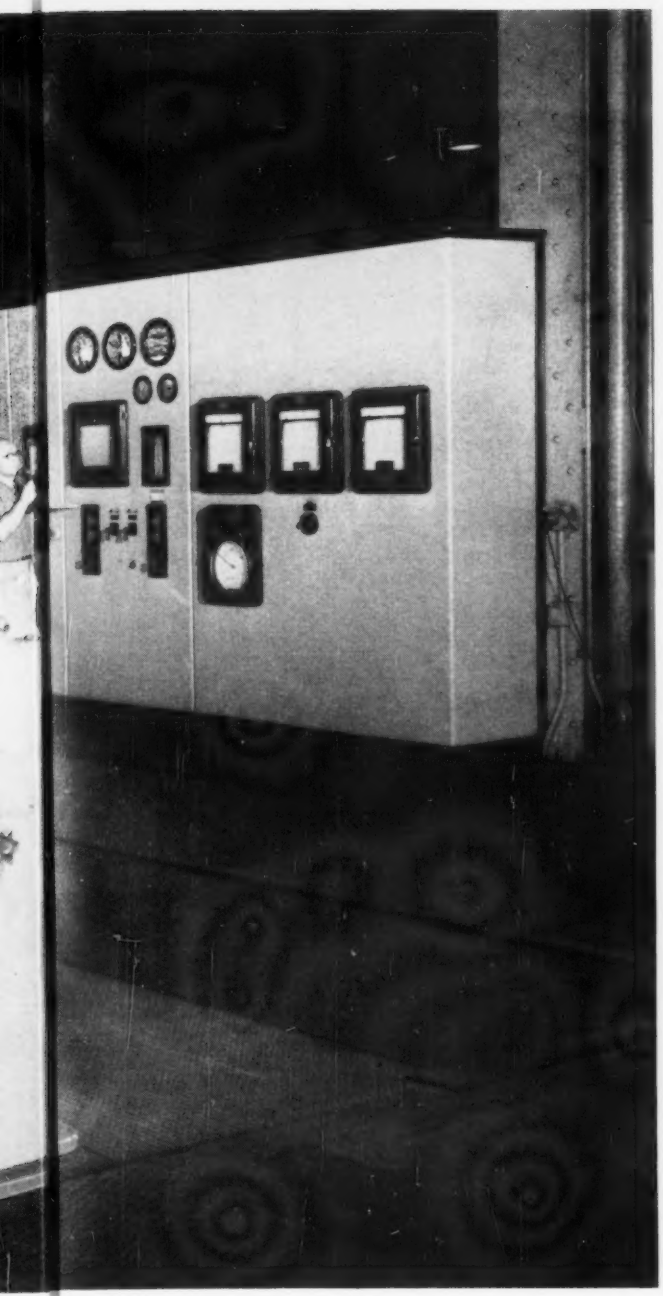
GULF MAKES THINGS

"During the last 17 years we have been using Gulfcrest turbine oil in all units and have had absolutely no difficulty with any of them due to oil failure."

An outstanding record? Yes, and the authority is Mr. B. H. Cheeseman, Supervisor of Operations at the Deepwater Power Station, Atlantic City Electric Co., Penns Grove, N. J. "And," he continues, "in that entire period our laboratory tests have consistently shown that the oil is stable, non-foaming, free of sludge and rust. Neutralization numbers are consistently low."

Mr. Cheeseman is not alone in agreeing that Gulf makes things run better. In Gulf's marketing area, more power is generated by central station steam turbines lubricated with Gulfcrest than with any other turbine oil.

Gulfcrest is the turbine oil produced by Gulf's exclusive Alchlor Process. This is an extra refining step.



B. H. Cheeseman (right), Supervisor of Operations, gets new lubrication recommendations from T. C. Park, Jr., Gulf resident manager.

Peter Egan, laboratory manager, makes periodic check on Gulfcrest. After 17 years the oil is still free of sludge and rust.

This 25,000 kw GE Turbine is one of five units (total, 230,000 kw) at Deepwater Power Station of the Atlantic City Electric Company. It has been lubricated with Gulfcrest for 17 years.

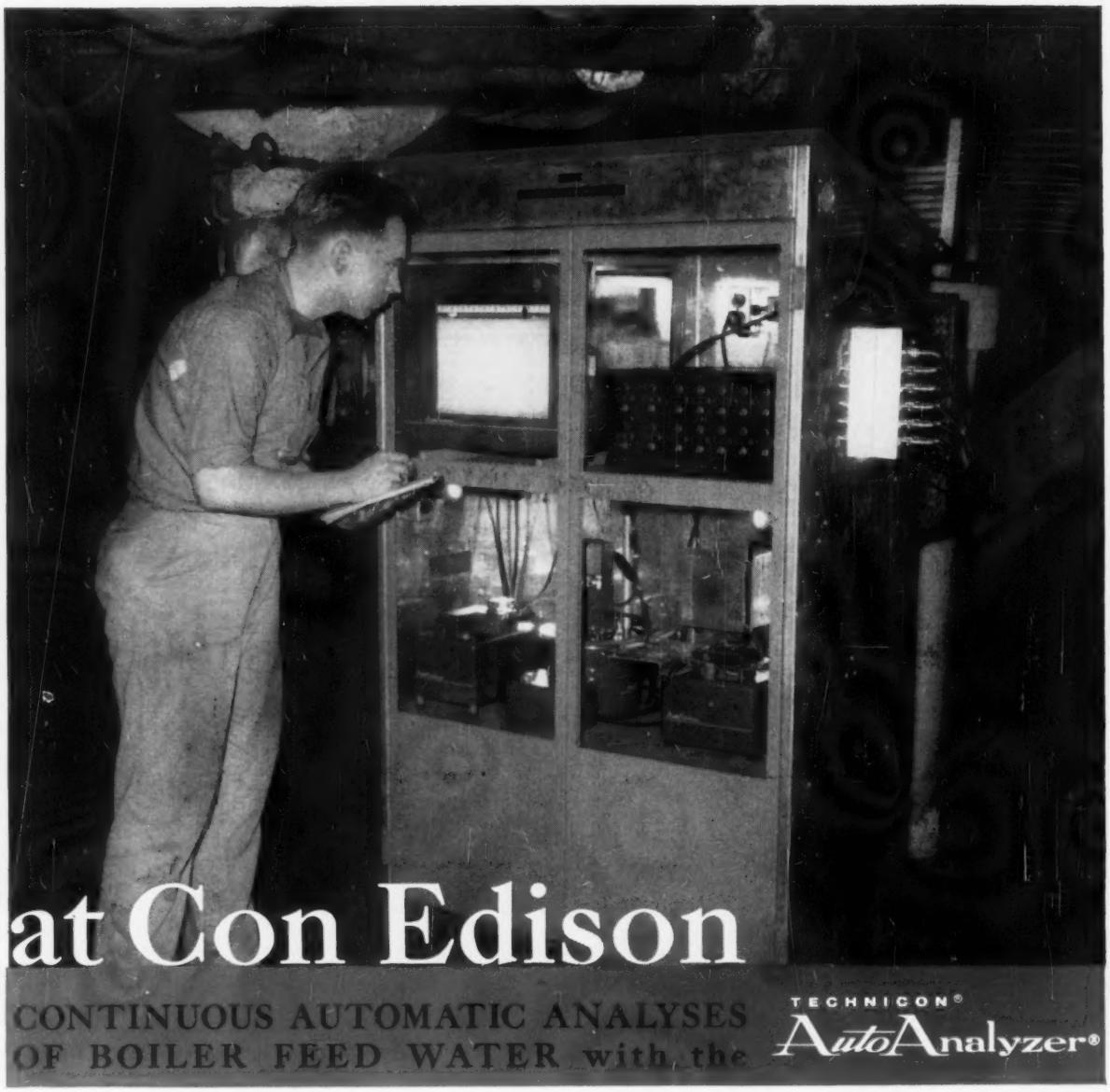
RUN BETTER!

It weeds out harmful unstable hydrocarbons which remain after normal refining. If allowed to remain, these hydrocarbons could oxidize, form sludge, emulsifiers and harmful acids. Without them, Gulfcrest lasts longer, helps to keep turbine systems clean indefinitely.

Your job is to keep your equipment functioning efficiently. Gulfcrest can help you do just that. A call to your nearest Gulf office will get you all the facts.

GULF OIL CORPORATION
Dept. DM, Gulf Building
Pittsburgh 30, Pa.

GULF



at Con Edison

CONTINUOUS AUTOMATIC ANALYSES OF BOILER FEED WATER with the TECHNICON® AutoAnalyzer®

Continuous automatic sampling and analysis of feed water for ten steam generating units, in cycles hundreds of times a day. In other control stations, AutoAnalyzers perform similar functions providing continuous chemical analyses without attendance. Precisely measures trace materials down to parts per billion ±1%.

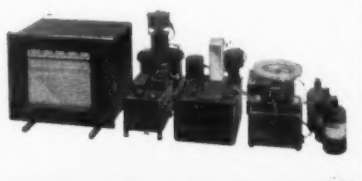
To receive your copy of the free AutoAnalyzer brochure plus specific application data, simply fill in the coupon below. No obligation, of course.

TECHNICON CONTROLS, INC., 100 Saw Mill River Parkway, Chauncey, N.Y.
Gentlemen: Please send me the TECHNICON AUTOANALYZER BROCHURE plus other pertinent data.

NAME_____ TITLE_____

FIRM_____ STREET_____

CITY_____ ZONE_____ STATE_____



TECHNICON CONTROLS, INC., Chauncey, New York

Wallace, if you'd read the Roebling Roeclamp® book this never would have happened!
ROEBL
ROECLAMPS
WITH ASSOCIATED CABLES
What a mess!

Free! The most electrifying news a utility company can read is contained in this new book about Roebling Roeclamps with Associated Cables. It tells all about the remarkable new aerial suspension clamps that give you a 5kv, 8kv, or 15kv system costing 60% less than self-supporting cables...a system that installs in a breeze, minimizes tree problems, carries more current, looks great, and which is virtually "storm-proof"! There's absolutely nothing like Roeclamps with Associated Cables...and if you distribute power, you need this book! No cost, no obligation—and the savings are all yours! For your copy, write today to Electrical Wire Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

ROEBLING

Branch Offices in Principal Cities • Subsidiary of The Colorado Fuel and Iron Corporation

Electrical Wire Division ew
John A. Roebling's Sons Corporation
Trenton 2, New Jersey

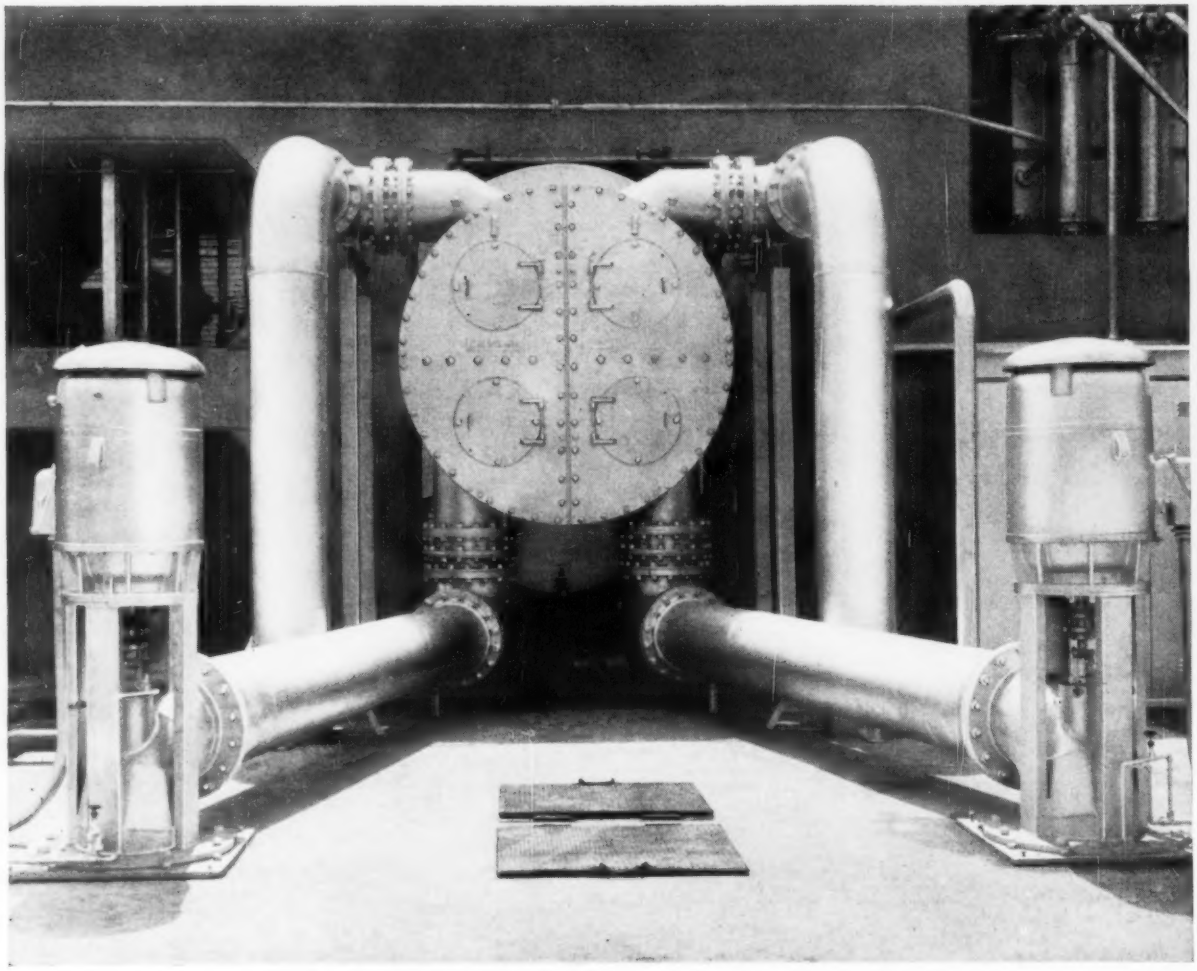
I WANT TO KNOW about Roeclamps with Associated Cables, so please send me your free book.

Name_____

Company_____

Address_____

City_____ State_____



This power plant was designed and built by the Crisp County Power Commission, Cordele, Georgia.

First planned gas-steam turbine station depends on C. H. Wheeler equipment!

The first power plant in the United States designed from the beginning as a combined gas turbine-steam turbine station, is now in operation!

This combined-cycle, 15,000 kw plant at Warwick, Ga., satisfies the daily peak-load condition as well as base-load requirements. The system is unusually flexible; it can operate with the steam turbine only, or in combination with the gas turbine.

C. H. Wheeler equipment now in service at this history-making station includes a 10,000 sq. ft. Dual Bank, Two-Pass Condenser and two 12″ x 16″ Vertical Mixed Flow Pumps shown above (which supply 10,300 gpm of cooling water) . . . two Horizontally Split Case Condensate Pumps, a Tubejet® Steam Jet Vacuum Pump and a Hogging Ejector.

This equipment symbolizes the contribution C. H. Wheeler makes to the efficient, economical operation of steam generating plants everywhere.

Depend on C. H. Wheeler Condensers for:

- ***Pure condensate***
- ***Lower absolute pressure, higher vacuum***
- ***"Zero" condensate temperature depression***
- ***Deaeration to 0.03 cc. per liter with special designs providing deaeration to 0.01 cc. per liter***
- ***Patented Reverse Flow for faster, easier cleaning of tubes and tube sheets***

C. H. WHEELER MFG. CO.

19th and Lehigh Avenue • Philadelphia 32, Pennsylvania

Whenever you see the name C. H. Wheeler on a product, you know it's a quality product

Steam Condensers • Steam Jet Vacuum Equipment • Centrifugal, Axial and Mixed Flow Pumps • Marine Auxiliary Machinery • Nuclear Products

This is a typical penstock in which USS "T-1" Steel could reduce over-all costs. USS "T-1" Steel has already been specified for use in three major penstock installations now under construction in Canada, Switzerland and India.

HOW USS "T-1" STEEL can cut the cost of penstock construction

The primary requirement of penstocks is *strength*, since they are, in effect, variable pressure vessels. To achieve the necessary strength with carbon steel often means extremely thick, heavy, hard-to-anchor sections. But, by using USS "T-1" Constructional Alloy Steel, weight and its attendant problems can be drastically reduced. Consequently, construction costs can be cut, installation time shortened, less welding required, handling simplified, smaller foundations required, etc. (See chart)

Such effective weight reductions are possible with USS "T-1" Steel because its very high yield strength (100,000 psi minimum) permits use of higher working stresses. And "T-1" Steel's exceptional toughness, even at very low temperatures, coupled with weldability, makes it the ideal construction material for penstocks, pressure vessels, scrollcases and standpipes. In tests, welded ½-inch-thick vessels of this remarkable steel have withstood stresses of as much as 136,000 psi without bursting—even when chilled to 45° F below zero.

Investigate USS "T-1" Steel for penstocks. Write for a copy of our new booklet, USS "T-1." United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.

Here's how costs could be trimmed in a hypothetical penstock installation by using USS "T-1" Steel.

PENSTOCK CONDITIONS:

Diameter	60 " I.D.
Length	5,975 feet
Maximum head	2,940 feet
Design stress	½ yield strength
Minimum thickness	⅜ inch

HOW USS "T-1" STEEL CAN SAVE ON MATERIAL, WELDING, PRE-HEATING AND STRESS RELIEVING

	Conventional Construction (ASTM A-285-C)	USS "T-1" Construction	Savings with USS "T-1"	Percent Saved
Weight of shell material	4,880,000 lbs.	2,100,000 lbs.	2,780,000 lbs.	57%
Cost of welding operations (estimated)	$ 65,000	$ 35,000	$ 30,000	46%
Cost of pre-heating and stress relieving (est.)	$ 55,000	———	$ 55,000	100%
Total cost—includes cost of material, foundations, fittings, handling, erecting and shipping	$1,220,000	$866,000	$354,000	29%

USS and "T-1" are registered trademarks

United States Steel Corporation—Pittsburgh
Columbia-Geneva Steel—San Francisco
Tennessee Coal & Iron—Fairfield, Alabama
United States Steel Supply—Steel Service Centers
United States Steel Export Company

USS United States Steel

There's a good reason WHY...

FAST DELIVERY

reduces your inventory

You don't need warehouses bulging with transformers to satisfy your day-to-day operating requirements. You can get fast delivery of one or a hundred transformers with a phone call to the nearest Allis-Chalmers district office. Local Allis-Chalmers stocks include conventional as well as self-protected and overload-indicating transformers in the ratings you most likely need. A representative range of instrument transformers is also available locally. Industry's most careful crating assures you the transformers will arrive in "factory condition," ready for years of dependable service on your poles.

For *all* the good reasons why Allis-Chalmers distribution transformers assure outstanding performance for many years, call your A-C man, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

A-5717

Editorial Comment

JANUARY 19, 1959

Let's Use Talent More Efficiently

Meter reading is an honorable calling, one that has provided an invigorating training ground for many of today's middle and top management men. Nonetheless, power companies might put meter reading manpower to better use.

In Bordeaux, the Electricite de France has successfully tried a twice-a-year meter reading interval. Now the utility proposes to follow the schedule for all its consumers. Bills would be estimated every two months on the basis of the previous year's consumption.

The proposal deserves serious study by U. S. utilities, we believe, particularly in light of the belt-tightening hangover of the recession. As for the customers' reaction, all but the perennially troublesome cranks would subscribe to this cost cutting. But how about our friend the meter reader? Simple. Transfer him to the sales department where his capability for legwork might set a healthy precedent for the incumbents and his personal acquaintance with customers could lead to added EAR.

Bequeath of Editorial Policy

In politics and on special issues, most newspapers take partisan sides, editorially. Almost all papers reserve the right to change editorial policy on an issue, if in the editor's opinion such is demanded by changing conditions. This open-minded willingness to review an issue in the light of shifting currents of time and events is a hallmark of the free press.

But this does not apply, apparently, to the potent McClatchy newspapers of California, at least on the "vital principle of government ownership." Under instructions from the grave, the Bee papers seemingly are committed forevermore to adherence of government ownership. Even should present editors feel personally they would no longer support this policy, they evidently would be powerless to alter the course set by McClatchy forebears.

Their "authority" derives, they say, from the sole codicil to the will of the late Charles K. McClatchy, former publisher of the Bee papers, dead since 1936. Charges the codicil: "One fundamental issue will never change and that is the vital issue of government ownership. I want the McClatchy newspapers to battle for that principle at any and all times no matter against what odds."

And responded the Sacramento Bee, as Feb. 3, 1958: "It is an injunction, this codicil, which has become the cardinal law governing all operations within the houses of The Bee—the yardstick by which all decisions have been measured by those who succeeded C. K."

The codicil does not confine the policy to electric power, and indeed the McClatchys have stood behind public acquisition of telegraph, ice, transportation and garbage-disposal facilities. Yet their prime target always has been the investor-owned electrical utilities of California.

As editors, we must decry the blind attitude of these who now control the McClatchy papers. Each editor, we insist, must be conscience-free to determine editorial policy in accord with his interpretation of current conditions.

If, as the Sacramento Bee implies, the Bee papers are restrained forever to a policy dictated in 1936, we feel they are performing a disservice to their area and indeed are straining the boundaries of editorial ethics.

Dual Standard Returns for Indiana Utilities

Court decrees that PSC doesn't have jurisdiction over co-op loans even though they're classed as public utilities

The status of the double standard has been reinstated in Indiana. A recent Appellate Court decision there states, in effect, that the Public Service Commission has jurisdiction over rural electric cooperatives' service areas and rates, but no say-so on the federal loans sought by the co-ops.

The PSC says it "will abide by the decision unless and until it is reversed by the (state) Supreme Court."

Co-ops Are Public Utilities

It was on the basis of a three-year-old Indiana Supreme Court ruling that the PSC issued an order requiring Rural Electric Membership Corporations, as the co-ops are called in the state, to obtain PSC approval before accepting loans from REA. The earlier ruling defined the REMCs as public utilities. On this definition, the PSC on March 7, 1958 began exercising on co-ops the same regulatory treatment that investor-owned utilities have received since the commission's inception.

In response to a question posed by Electrical World, Leslie Duval, commission member for three months, said that the Appellate Court's decision means the PSC will operate on a double standard—one for co-ops and one for power companies. "The only thing is, according to the Appellate Court, the double standard is legal," he said.

The PSC's position now does not rule out the possibility of the issue being taken to a higher court. An injunction by a private party would take the question to the Supreme Court.

Legislation to clarify the PSC's jurisdiction over co-op loans may be introduced before the current session of the Indiana legislature.

The Appellate Court revoked the Public Service Commission order declaring it to be "contrary to law and of no force and effect," in an unanimous opinion. The REMC action was brought by Boone, Hancock, Hendricks, Johnson, Morgan, and Knox County REMC's, the Indiana Statewide Rural Electric Cooperative, Inc, and the Southwestern Indiana REMC's acting on behalf of 43 REMC's.

Meanwhile, the first effect of the Appellate Court ruling was a go-ahead issued by the REA for Knox County REMC at Vincennes to start drawing on a $619,000 loan. The loan had been approved earlier in 1958, but the REA had withheld funds because of the PSC order.

The Appellate Court's action may make things easier for Hoosier Cooperative Energy, Inc, a group of REMC co-ops that are intent on developing their own power generating sources. Originally, the group consisted of 18 co-ops that sought to build a $42-million, 198,000-kw steam plant. Part of the output would have been sold to supply an aluminum ingot plant that was to have been built near the facility.

Hoosier Group Alters Plan

Now, however, the aluminum company has changed its relocation plans and the Hoosier group is altering its proposal.

A newly-formed "Southeastern District" of the long-proposed Hoosier co-op group is expected to file an application shortly with the Rural Electrification Administration in Washington for funds to build its own generation and transmission facilities in Indiana.

Southeastern and a similar "Southwestern District" group would replace the defunct 1957 Hoosier proposal for a $42 million REA loan to build a 198,000-kw generating plant. However, neither of these new proposals would include power for a proposed aluminum plant in the area, as planned in the original Hoosier application.

Southeastern reportedly has hired the Stanley Engineering Co to draw up plans for G&T facilities of unknown capacity. The project would furnish power to co-ops in the Southeastern group.

Harrison County Rural Electric Membership Corp, Corydon, Ind., a member of the Southeastern group, was granted a 24-month priority permit by the Federal Power Commission in October, 1958, to study the feasibility of an 80,000-kw hydro plant at the Corp of Engineers' proposed Cannelton Dam across the Ohio River.

As planned, Harrison would use the power for its own needs and for sale to other co-ops in the area, probably the Southeastern group. Harrison also indicated in its Federal Power Commission application that it would seek an REA loan to build the plant, if it proves feasible. However, the Cannelton Dam may not be built for ten years, according to the Corps of Engineers' estimates.

Companies Fought Back

Indiana power companies fought the first Hoosier proposal vigorously, contending that the project would be not only a drain on taxpayers but that the plant's output would be far in excess of present kwhr sales by the co-ops. In addition, the companies pointed out, that by 1960 they will have an estimated reserve capacity of more than 850,000 kw, or more than enough to serve the projected needs of their co-op customers.

Raft of Bills on Power in Hopper

Columbia River Authority, TVA bond measures readied; Morse studies Hells Canyon

Sen Richard Neuberger will push for a Senate vote this year on his Columbia River Development Corp bill, to create a federal "valley type" power marketing authority in the Pacific Northwest.

Neuberger's bill, now being revised by the Northwest Public Power Association, will be introduced in early February, and will include no major changes from the version used in December hearings. NWPPA has gone along with a clause in the bill to modify Bonneville Power Administration's federal preference clause "to prevent geographical concentration" of power sales, indicating a break in the log-jam among public-power supporters who have opposed the modification.

Sen Wayne Morse will introduce his new Hells Canyon bill as soon as he has the results of a feasibility study—probably in early February—to determine whether the benefit-cost ratio still would be favorable for a high federal dam after including condemnation payments to Idaho Power Co for flooding out its three-dam project.

TVA Will Bring First Big Fight

The first major power fight in Congress probably will come over a TVA bond-financing measure. Sen Robert S. Kerr is expected to introduce a bill similar to the version passed by the Senate in late 1957; Rep Clifford Davis is expected to introduce a bill in the House similar to his previous bill, which was bottled up in the House Public Works Committee. Davis will make a gesture toward including a few minor limitations in his new bill—probably a mild definition of the area in which the funds could be spent.

No bill or action is anticipated in the near future to settle Pacific Gas & Electric Co's "partnership" proposal to build and operate the power facility at the federal Trinity project in California. Instead, a waiting-game is expected; and if the House Interior Committee (under its new chairman, Wayne Aspinall of Colorado) takes no action by mid-spring, the Administration probably will be forced to ask for funds to build a federal power facility at the dam.

Other power-related bills, introduced during the first week of the 86th Congress include:

- HR-1321 by Rep Melvin Price (D-Ill.) to give the administrator of REA final authority in making loans to co-ops and to "free" him from loan reviews by the Secretary of Agriculture. The bill is similar to one he introduced last year. An identical bill will be introduced in the Senate by Sen Hubert Humphrey. Bills referred to respective government operations committees.
- HR-8 and HR-289 by Rep James Trimble (D-Ark.) to reduce the cost-base for power produced at federal multi-purpose dams to cover only the added cost of the generating facilities. Bills, identical to ones he introduced in last session, have been referred to the House Public Works and Interior committees, respectively.
- HR-1781 by Rep Frank Becker (D-N.Y.) to increase the interest rate on REA loans to cover the cost of obtaining the money by the U. S. Treasury. The bill, similar to his previous bill, has been referred to the House Agriculture Committee.
- HR-1235 by Rep Hamer Budge (R-Idaho) to authorize a federal power dam at the Burns Creek, Idaho, site; referred to the House Interior Committee.
- HR-1223 by Rep Alvin Bentley (R-Mich.) to repeal manufacturers excise taxes on refrigeration and self-contained air conditioning equipment and electrical appliances; referred to the House Ways & Means Committee.
- HR-370 by Rep Edgar Hiestand (R-Calif.) to remove the federal tax exemption on co-ops engaging in "political propaganda." The bill, similar to his previous one, has been referred to the House Ways & Means Committee.

Co-op Tax Proposed

- HR-198 by Rep Noah Mason (R-Ill.) to tax all farm co-ops equally as business corporations, similar to his previous bill; referred to the House Ways & Means.
- HR-1340 by Rep John Rhodes (R-Ariz.) to permit "lower basin" states to utilize funds from the Colorado River development fund; referred to the House Interior Committee.
- HR-292 by Rep James Trimble (D-Ark.) to authorize additional federal hydro power development in the White River Basin; referred to the House Public Works.
- HR-99 by Rep Burr Harrison (D-Va.) and HR-733 by Rep Marguerite Church (R-Ill.) to limit government activities which compete with private enterprise; referred to the House Government Operations.
- S-144: Sens Hubert Humphrey (D-Minn.) and Mike Mansfield (D-Mont.) introduced their bill, S-144, to "free" the REA administrator from any review of loans to co-ops by the Agriculture Secretary; referred to the Senate Government Operations Committee. Bill is identical to HR-1321, introduced in the House by Rep Price.
- HR-1381 by Rep Roy Wier

(D-Minn.) to establish a Missouri Valley Authority; referred to House Public Works Committee.

- S-75 by Sens Carl Curtis (R-Neb.) and Richard Russell (D-Ga.) to establish the REA as an independent agency; referred to the Senate Agriculture Committee.
- S-133 by Sen Homer Capehart (R-Ind.) to increase the interest rate on REA loans to co-ops to equal the cost of obtaining the money by the U. S. Treasury; referred to the Senate Banking & Currency Committee.
- S-223 by Sens Glen Beall (R-Md.) and Harry Byrd (D-Va.) to permit Potomac Electric Power Co to build a power dam across the Potomac; referred to the Senate Public Works Committee.
- HR 372 by Rep Edgar Hiestand (R-Calif.) to increase REA interest rates and to require borrowing co-ops to pay a fee to REA covering administration costs; referred to the House Agriculture Committee.

5-Mw Reactor Planned for General Public Utilities

Westinghouse Electric Corp will build a 5,000-kw nuclear reactor plant for the General Public Utilities system for use at a power station now in operation near Saxton, Pa.

The plant, a joint undertaking of Westinghouse, the GPU system, and Gilbert Associates, will be hooked on to an existing turbine generator unit at Pennsylvania Electric Co's Saxton station 100 mi east of Pittsburgh.

Westinghouse has retained Gilbert Associates as sub-contractors for engineering and construction of the facility. The reactor is scheduled for operation in summer, 1961.

The plant will be of the pressurized water type, according to Charles H. Weaver, vice president in charge of atomic power activities for Westinghouse. "From an intensive research and development program, we expect to gain vital information which will greatly advance the technology of all water-cooled and moderated reactors," he said. R&D will include studies on increased life and heat generating capacity of various core designs, and investigation of nuclear superheating.

AEC Advisory Group

It urges vigorous government effort on an atom program but insists emphasis now should be on prototype plants

An industry advisory committee has come up with recommendations on atomic power that may prove to be the bridge between conflicting views of the Atomic Energy Commission and Democratic champions of an expanded program.

A committee appointed by AEC Chairman John McCone says the federal government should push forward vigorously to achieve competitive U. S. nuclear power within ten years—and that the AEC should build the necessary prototype reactors whenever private industry doesn't.

Large Plants Should Wait

However, the group insists construction of large-scale reactors should wait for the day when private industry is ready to build them as economic power producers.

The AEC is expected to accept most of the recommendations, and the group's report is receiving a generally friendly reception on Capitol Hill.

But the big question still is whether economy-bent officials of the Eisenhower Administration on the one hand, and Congressional advocates of public power on the other, can be persuaded to give the attempted compromise a chance.

In general, key Democrats charge that the Administration's "partnership" program—in which AEC supports research and development for privately-owned reactors—has been used too often as a buffer and delaying mechanism against Democratic pressure for federal reactors.

The Republican Administration, in turn, suspects some important Democrats are determined to put a public power stamp on the atom.

For more than a year, AEC and the joint committee have been trying off-and-on to agree on a long-range development program which also would be supported by the atomic industry. Some progress has been made—particularly since the departure of Lewis L. Strauss from the AEC chairmanship last summer.

The atom commission has agreed to exercise a stronger technical direction of the development program, and the long-range objectives issued by Atomic Energy Commission and the joint committee are not too far apart.

However, it has been obvious since budget discussions began in the fall that any acceleration attempt would run smack into the Administration's determination to hold the line on spending. And President Eisenhower's $77-billion budget, as expected, seeks to hold spending for civilian atomic power development roughly at current levels despite AEC requests for a much larger figure.

AEC staffers say budget restrictions are bound to limit the number of reactor concepts which can be realistically pushed—a result that does not sit well with expansion-minded Democrats in Congress.

Against this background, the report by the industry advisory committee appointed by McCone in October appears calculated to offer something to both sides.

Chairman of the committee is Alfonso Tammaro, assistant general manager for research and industrial development, AEC. James B. Black, board chairman, Pacific Gas & Electric Co, is a member.

Goals Endorsed

The group endorses the program objectives on which AEC and the joint committee are in general agreement: U. S. leadership in developing atomic power technology, achievement of competitive nuclear power in high cost areas of the U. S. within ten years, and achievement of the same goal in high-cost foreign areas even sooner.

AEC's technical program aimed at achieving these goals is also judged "generally sound." And the committee's philosophy on the government's role in atomic power development is not far from the joint committee's.

"It is not yet possible for the

Attempts to Bridge the Gap

federal government to divest itself of the responsibility for development of nuclear power technology," says the report. . . . "The federal government must exert positive leadership. More specifically, the AEC must . . . be recognized as responsible for technical decisions," such as the type and size of reactors to be developed under the "partnership" program.

"Such a system should not discourage industrial initiative," says the committee in a statement with which some utility executives take strong exception. "It is always possible and desirable for industry to make suggestions."

U.S. Not in 'Kw Race'

However, the group insists the U. S. is not in a "kilowatt race" and should concern itself more with advancing technology than with construction of reactors for its own sake.

Although the advisory committee declines to outline a time-schedule for various reactor types, it has opinions which — if accepted — would have a major bearing on the scope and direction of AEC's future efforts:

- An increase in spending over the current level is recommended for general applied research. The committee calls for increased efforts on development of a less expensive fuel cycle, and on such problems as determining the real potential of Uranium-233 for thermal breeder reactor fuel.

This proposal is tied to the committee's feeling that AEC must work now on reactor concepts which cannot produce economic power in the short run, but may hold promise for the 1980's.

"We have heard the suggestion made that work on all types, other than the one or two now well advanced, should be dropped," the group comments. "We believe this would be a mistake."

- Construction should begin in 1959 on a gas-cooled reactor prototype similar to that designed by Kaiser Engineers and ACF Industries. In addition, if the current technical review underway at AEC so indicates, the commission should support R&D required for the advanced gas-cooled reactor proposed by Philadelphia Electric Co.

This might open the way to a compromise agreeable to Democrats who insist AEC build the Kaiser-ACF reactor whether or not the Philadelphia partnership proposal is approved.

The advisory commitee also advises construction in 1959 of one or two advanced boiling water prototypes, plus prototypes of pressurized water and organic-cooled reactors if studies are favorable.

Thus, a total of four or more prototypes are recommended for early construction—preferably by industry with AEC help, but by the government if adequate industry proposals are not received.

- Large-scale plants should be built only when their costs are low enough to be acceptable to utilities on a business basis.

The committee concedes that reactor economics are apt to be more favorable in large-scale plants of, say, 200-Mw capacity than in a pilot plant. But it argues that two or three generations of prototype of a particular reactor concept can be built for the cost of one large reactor—and, consequently, more technological lessons can be learned.

This is the proposal, which if adopted by AEC, will run into the sharpest fire on Capitol Hill. Democrats such as Sen Albert Gore (D-Tenn.), whose views are close to the public power co-op bloc, insist nuclear power won't become competitive until the government builds large plants.

Anderson Okay Possible

However, there are reports Sen Clinton Anderson (D-N. M.), joint committee chairman, will take a more tolerant view of the advisory committee's emphasis on prototypes. For one thing, the group leaves the door open for a form of financing toward which Anderson and a large segment of the atomic industry leans.

The advisory committee has no objection to capital grants (such as AEC payment of a portion of the difference in the cost of constructing a conventional and nuclear power plant). The group adds this note to its comment on large-scale plants: "We are skeptical of the need for such plants before costs are substantially reduced. However, we do not wish to preclude government assistance if the major portion of the construction is financed by utilities . . ."

The big question now is how the advisory committee's recommendations, if adopted by AEC, can be made to track with the lid clamped on spending by the President's budget.

Cost: $150 to $200 Million

If you accept estimates set forth by the advisory group, there's no problem. It claims government spending under its proposals would run $150 to $200 million—compared to $190-million in the current fiscal year.

The committee figures that by substituting prototypes, $50 million per year could be cut off the cost of the program in the next five to seven years. There's considerable doubt among atomic industry sources that the estimate is realistic unless industry builds most of the prototypes with only limited federal help.

Nevertheless, the advisory group argues that greater expenditures are not essential, and that a "crash program" actually might distort the technology and cause a waste of nuclear fuel.

Democrats are apt to take this with a huge grain of salt, and there's speculation in Washington that McCone himself will wind up using the advisory committee's report in efforts to wring approval of more spending from the Budget Bureau.

AEC's public attitude toward acceleration of the power reactor development program will become apparent in mid-February when the joint committee opens its annual atomic hearings. The commission is expected to defend the spending ceiling.

But as one Congressional source puts it, "I wouldn't be surprised if, behind the scenes, you'll find AEC and the joint committee on one side and the Budget Bureau on the other."

Total-Electric Home Promotion

All-electric campaign is first to make electric heating the focal point. Manufacturer will launch $2.5 million program in 1959

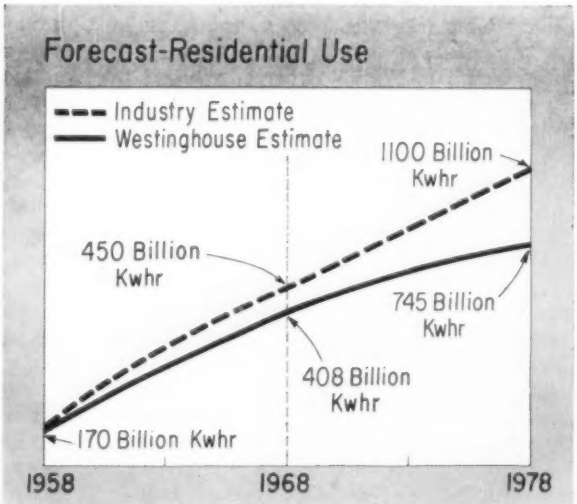
Westinghouse Electric Corp will launch a $2,500,000 campaign this year to stimulate construction of Total-Electric Homes and influence the electrical modernization of existing homes. The program will emphasize the use of electricity for home heating and cooling.

Chris J. Witting, vice president and general manager, consumer products group, said, "Westinghouse will use all of its selling, advertising, and promotional means to establish the idea of the Total-Electric Home in the minds of the people of this country. The Live Better Electrically program and the EEI program are providing an excellent start along this line. They are all in the right direction," he said. "With these programs as a base we should now narrow the target down to what is really our main objective—getting homes built where everything is run by electricity."

Westinghouse picked the name "Total-Electric Home" because, "We've been worried for a long time that people felt they already had an all-electric home if they merely had quite a few electrical appliances," Witting stated. "The words 'Total-Electric Home' . . . will alert people's attention to the fact that this is something different.

"Electric heating is at the heart of the Total-Electric Home—it's the key to the whole problem. It gives broader and more dramatic appeals and is a new and provocative idea about which the industry can talk."

Westinghouse lists these advantages to selling a Total-Electric Home:



RESIDENTIAL LOAD growth is shown by dotted line. Solid line shows Westinghouse forecast. Company feels the discrepancy can be eliminated by selling electric heating

1. An average Total-Electric Home uses 8 to 10 times the 3,300 kwhr of today's average home.

2. The Total-Electric Home will spread out and help in the sale of every electric device that makes up the total residential load.

3. When a Total-Electric Home is sold, a complete electrical package is being sold. And the trend today is toward packaged, one-stop buying.

4. When a Total-Electric Home is sold, the inadequate wiring problem disappears, because this type of residence is always adequately wired.

While Westinghouse is talking the idea of the Total-Electric Home, they will put special emphasis on electric heating—because, as they see it, it's the key to the whole problem.

"We are well aware that in some areas of the country, the cost of operating electric heating is a problem," Witting said. "But we also know that electric heating, properly planned and installed, is the finest and most comfortable form of heating in the world. It is clean, odorless, quiet and safe. We want this idea to come through."

Electric Heating Not Expensive

Westinghouse pointed out that the question of cost is in many people's minds. But their studies show that in the majority of places in this country electric heating is not expensive when balanced against the many benefits it offers.

"We also know that the idea of Total-Electric Living is well within the means of millions of people in this country. It's to those people that we will be telling this story in a spectacular three-page ad which will appear in May in LIFE magazine," the company's executive pointed out.

The electric heating block is strategic for two reasons, according to Witting.

1. When electric heating is in the home, electricity will probably be the only source of fuel or energy. Anything else usually becomes uneconomical. "This reason alone is enough to warrant all the effort the industry can muster," he said.

2. For many electric utilities, electric heating balances the load from air conditioning in the summer cooling season.

The engineering principles of electric heating are known. Space heating especially is easy to apply, easy to install, and easy to maintain. And because the growth potential has so few limitations to it, experience shows it responds in direct proportion to effort, Witting said.

"All of us in the industry have moved with a great deal of caution to avoid any premature plunge into electric heating. While both electric utilities and manufacturers have built up a considerable body of experience in this field, our efforts have never really been synchronized and there's no doubt that many electric utilities today have developed aggressive programs that have moved them far ahead of the manufacturers.

"Westinghouse has developed the Total-Electric

Launched by Westinghouse

Home program as a rallying point for all in the industry who may want to move with us," Witting stated.

"We think it's the best single thing we can do for our own company at this time, but also we think it's the best single thing we can do for the entire electrical industry."

The primary stimulus that encouraged Westinghouse to undertake this promotional program came when they reviewed their residential load forecasts. In looking long and hard at these, they were convinced of one significant fact: The rate of load growth in the residential area in the 10-20 years ahead will decline unless something is done.

If residential loads continue to grow at the same rate they have in the past 10 years, the dotted line (chart, p 32) shows what happens.

However, the Westinghouse forecast (solid line) indicates that residential load will not grow as fast as in the past.

"But the important point here," said Witting, "is that we think electric heating and cooling and all the other things it will carry along with it can make up the gap between our forecast and the historic rate of growth."

The total residential load can be broken into several smaller "load blocks," (chart, this page).

Westinghouse has developed forecasts for these blocks for the next 20 years. The electric heating and cooling block is particularly interesting—especially electric heating—since it shows by far the greatest growth possibilities.

The electric heating and cooling trend line shows that the number of homes that are electrically heated will grow from ½ million in 1958 to 2.2 million in '68, and to nearly 8 million in '78.

Forecast Subject to Change

However, the forecast is conservative in that it does not assume there will be a significantly greater promotional effort in the future on the part of the electrical industry than there has been during the past few years.

"If the industry does nothing," Witting said, "the showing could be much poorer; on the other hand, if we really organize an intensive program to promote and sell electric heating, it's within the realm of possibility that we could have as many as 4 million electrically heated homes by 1968 and 20 million by 1978."

The Westinghouse approach to the Total-Electric Home breaks down into two parts: The seating of the Total-Electric Home idea, the concept of it on a broad scale; and sales, education and training aids in specific areas where the Total-Electric Home must ultimately be sold.

For the first part, Westinghouse commissioned an architectural group to design a Total-Electric Home. Instead of highlighting specific appliances, the model home emphasizes electrical centers: Centers for entertainment, weather control, food preparation, laundry and others.

It will be a Gold Medallion Home. "The Medallion Home Program has had outstanding acceptance already. With the permission of the Live Better Electrically people and EEI, we will be building completely on that very solid foundation," Witting noted.

In the Total-Electric Home, working models of the different electrical centers have been built. These will travel around the country on exhibit.

The consumer phase of the program will have the support of the major mass media, exhibits at home shows, and a travelling display.

Advertising in consumer publications will showcase the fact that many wonderful features of the Total-Electric Home are here today. It will get across the impression that the consumer is missing a lot in "partial" application of electricity. Most important, it will show what can be done in building or modernizing so that home owners will be ready for electric heating in the future.

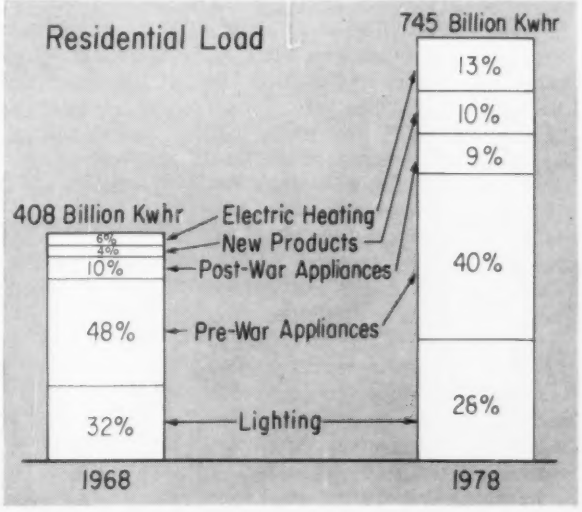
Second Phase to Stress Education

For the second phase, Witting pointed out that there is a big training job to be done on the Total-Electric Home and especially on electric heating.

"We also know that there is an educational job to be done in our own industry—to acquaint people with the facts about electric heating and about the cost.

"We know it takes a well-planned and well-backed sales program, both by electric utilities and manufacturers, often working together, to get Total-Electric Homes actually built.

"We are now working on many areas I've mentioned. We will be coming to the electric utilities in a few months individually to let them know specific details of the plans."



ELECTRIC HEATING shows the best growth possibilities. Appliance drop-off is precipitated by saturation of some pre-war items. News products will have to take up slack

LEWISTON POWER PLANT on escarpment of Niagara River will have a capacity of about 2,600,000 hp or 1,950,000 kw, and will appear as in this artist's rendering. It will be one of two generating plants in the Niagara Power Project

Niagara Hydro Power Project

Authority's project, including 2,190-Mw Lewiston Station, largest hydro plant in hemisphere, will be ready in 1962

JOHN SALOMA, Electrical Engineer, Chas. T. Main, Inc., Boston, Mass.

Two power plants, an intake structure, a switchyard, and an extra-high-voltage transmission line are the major elements of the Niagara Power Project to be built by the Power Authority of the State of New York near Lewiston. The hydroelectric project's total capacity will be about 2,190 Mw, largest in this hemisphere.

Most of the major construction contracts have been awarded for the project which will cost an estimated $705 million. Construction work is scheduled for completion by December 1962, when the first unit will have been in commercial operation for about 10 months.

Lewiston Power Plant will be on the escarpment of the Niagara River some 3 miles below Niagara Falls and opposite the Ontario Hydro Sir Adam Beck II Station. The combined pumping-and-generation Tuscorora Power Plant will be on the plateau about a mile east of Niagara River, and Niagara Switchyard will be sited on the plateau between the power plants. The EHV transmission line will join the switchyard to the Adirondack Substation of the St. Lawrence Power Project.

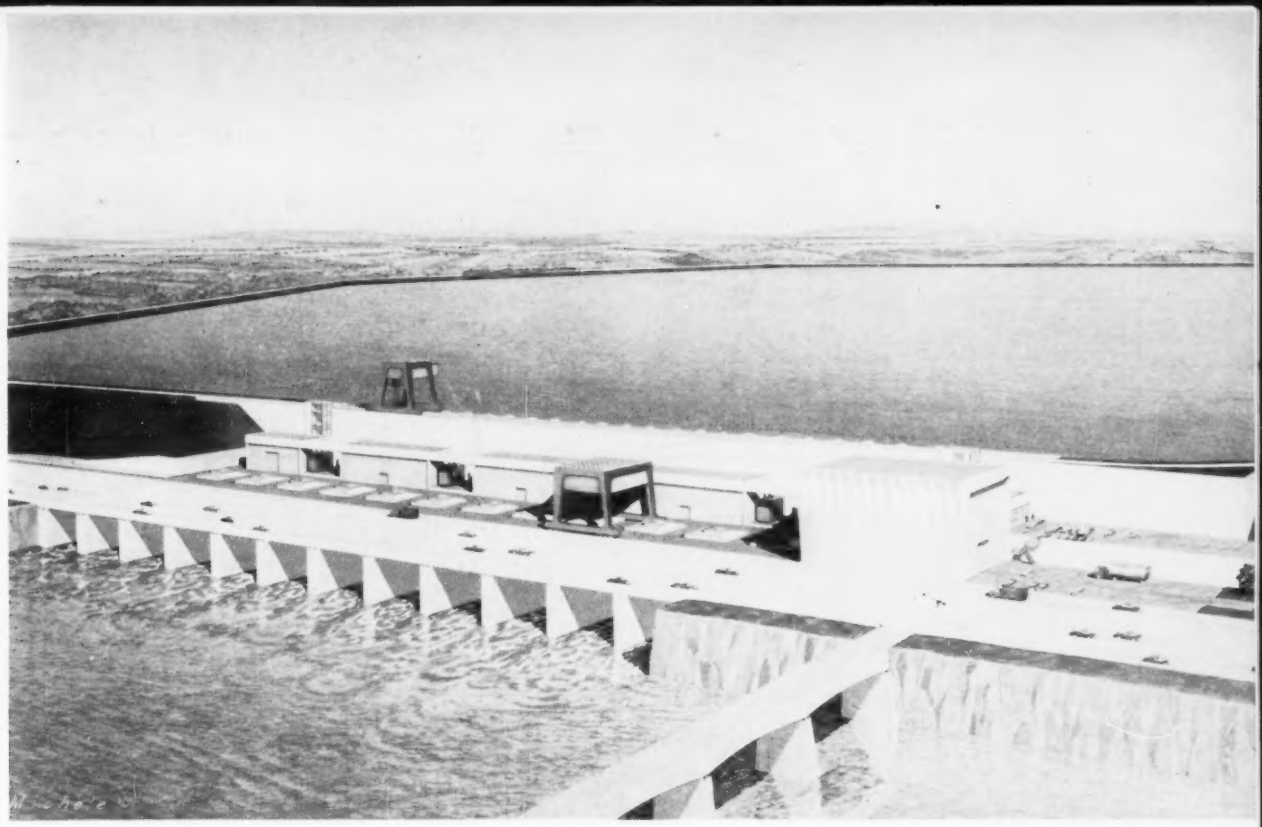
Modified Outdoor Type

Niagara River, linking Lakes Erie and Ontario, has an annual average flow of about 205,000 cfs. About 70,000 cfs will be available to the new project. The Lewiston Plant will have a capacity of about 1,950 Mw; Tuscarora Plant, 240 Mw.

Lewiston, the main generating station, will be a modified outdoor type station without superstructure over the generator deck. It will house 13 vertical hydraulic turbines of the Francis type, each with a capacity of 200,000 hp at point of best efficiency, under a net head of 300 ft. Water requirements for each turbine will then be about 6,250 cfs. For a maximum rating of 230,000 hp and a head of 292 ft, the rate will be 7,700 cfs per unit.

Generators will have a nameplate rating of 150 Mw or 167,000 kva at 90% pf and will operate at 120 rpm, 13.8 kv, 3-phase, 60 cps. They are designed to withstand all mechanical stresses at the maximum runaway speed of 206 rpm. The generators will be the vertical-shaft, umbrella type with a combined guide-and-thrust bearing below the rotor but no upper guide bearing. High-pressure oil lubrication, applied at less than 50% rated speed, will start and stop the unit. The conventional transformer-type grounding will limit generator ground-fault currents to a few amperes.

The station's design was based on a straight unit system, wherein



TUSCARORA POWER PLANT will be a combined pumping and generating plant, located on the plateau about a mile east of the Niagara River. Like Lewiston Station it will be connected to Niagara Switchyard between the plants

ct to Cost New York $705 Million

each generator is connected to the high-voltage bus through a step-up transformer and a high-voltage breaker. No 13.8-kv generator breaker will be provided.

Generators will be connected to the main step-up transformers by 8,000-amp isolated-phase bus. There will be taps from this bus to a generator surge protection cubicle and a 300-kva unit station service transformer. Main step-up power transformers will be two-winding, 180 Mva, 3-phase, 60 cps, forced oil-forced water cooled. Seven will step up the voltage to 120 kv; six to 240 kv. BIL for the former has been reduced one step, from 550 to 450 kv, and for the latter a step and a half to 825 kv.

Tuscarora has been designed as a peaking plant, its generator/motors to be run as synchronous motors at night when the system load requirements fall off and more water is available. The motors will drive the hydraulic pump/turbines as pumps, bringing the excess water from the tailrace or surge canal into the reservoir. The reservoir's approximately 2,880 acres will have a capacity of 60,000 acre ft. Head will vary between 55 and 95 ft.

Rated at 25 Mva

The water will be released during the daytime or peak hours to operate these same pump/turbines and drive the generator/motors as generators. Water, discharged into the Tuscarora tailrace, will flow into the power plant intake and be reused to operate the main turbine generators there. Thus more generating capacity will be made available when power requirements are at a peak. Power to drive the generator/motor units can be obtained from Lewiston Plant or from nearby thermal plants when the latter is more economical.

Tuscarora Power Plant will have 12 vertical hydraulic pump-turbines of the modified Francis type, rated to discharge 3,400 cfs at 75 ft net head as turbines. Generator/motors when operating as generators will have a nameplate rating of 25 Mva, 80% pf, 13.8 kv, 3-phase, 60 cps and will operate at 112.5 rpm with a maximum runaway speed of 202 rpm. Operating as motors, they will have a rating of 37,500 hp, 100% pf, 13.2 kv, 3-phase, 60 cps and will operate at 112.5 rpm also.

Three generator/motors will be connected to one transformer, each transformer rated 100 Mva, 13.2 to 240 kv, 3-phase, 60 cps, two-winding, forced-oil-forced water cooled, with a reduced BIL of 825 kv. Generator breakers will isolate the unit from the system or will synchronize when necessary, and isolated-phase bus will connect the generator/motors to the transformer.

High-pressure, oil-pipe-type cable circuits will be used in lieu of overhead transmission lines between power plants and the switchyard. Seven 115 and six 230-kv circuits, each with a capacity of 200 Mva, will connect Lewiston with the switchyard. Four 100-Mva, 230-kv circuits will connect Tuscarora with

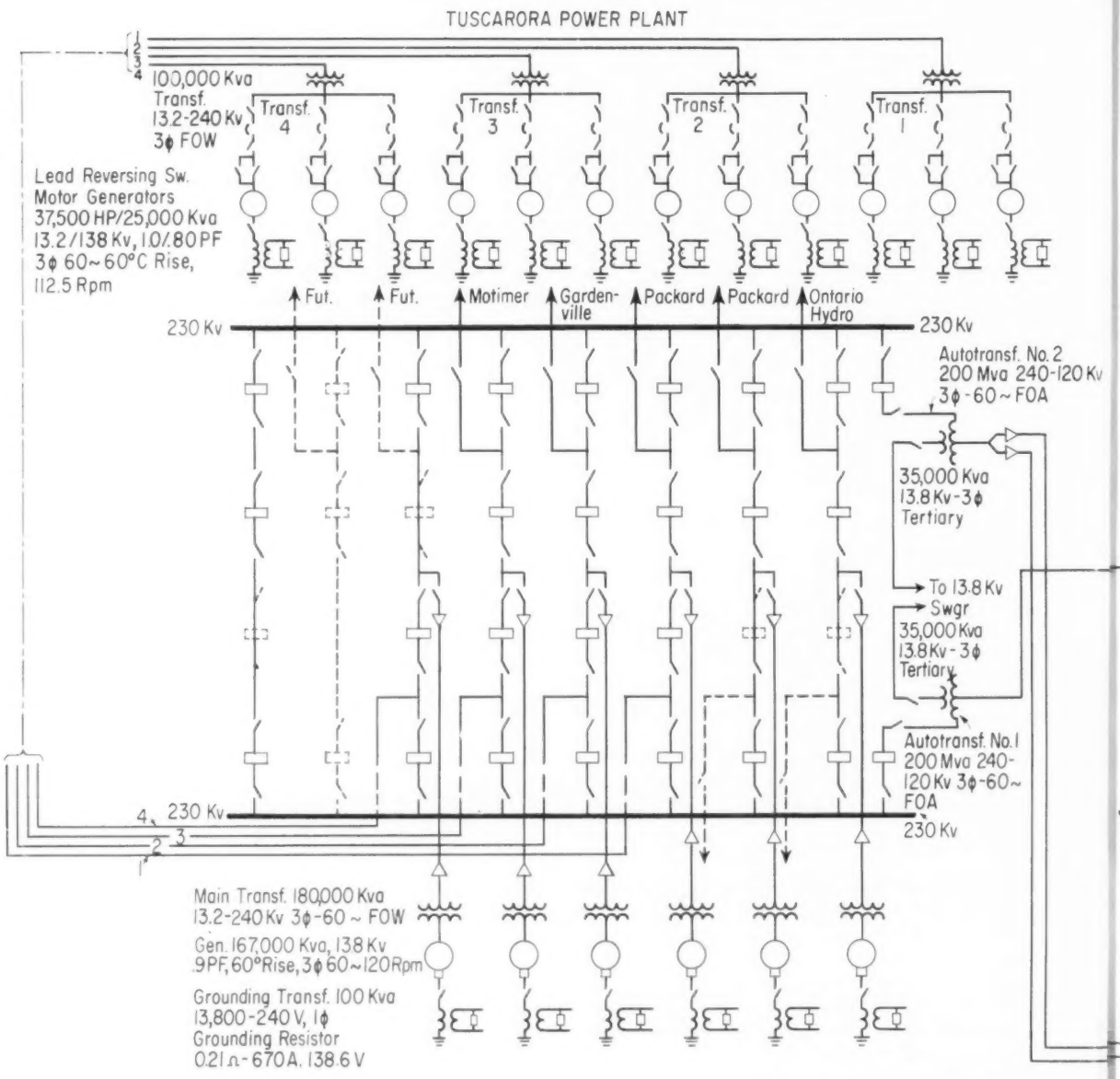


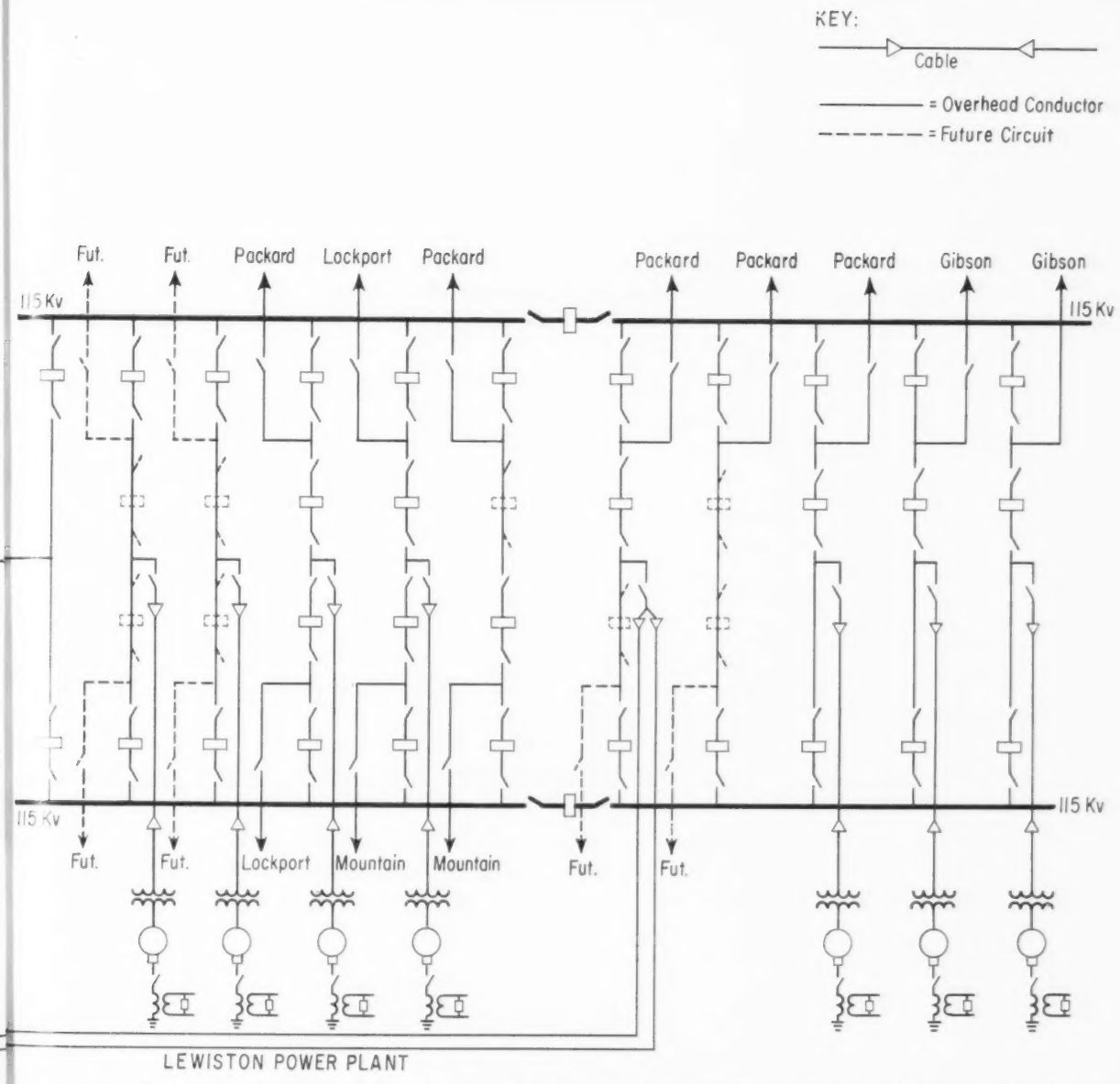
DIAGRAM shows the major elements in the Niagara Power Project, including Lewiston Generating Station (lower section), Niagara Switchyard (in middle area), and Tuscarora Power Plant (upper part), and the manner of interconnection

the switchyard. Right-of-way requirements and the entry into the switchyard would have created costly problems for overhead lines.

Only three high-voltage cables, with a total capacity of 600 Mva, will be installed in a single tunnel, thus limiting the loss of generating capacity at Lewiston to about a fourth of station output were one tunnel involved in a major disaster. The cable circuits from powerhouse to switchyard make feasible the three and four breakers per switchyard bay, as both ends of the bay are available for outgoing transmission.

Niagara Switchyard will have two double-bus, 115-kv sections and one double-bus, 230-kv section. Two 200-Mva autotransformers will connect the 230-kv buses to each 115-kv section. The two autotransformers will be rated 200 Mva, 240-120-13.8 kv, 3-phase, 60 cps, forced oil-forced air cooled, providing for an interchange of power between the 115 and 230-kv systems. The tertiary of each autotransformer will be connected to one section of a 13.8-kv switchgear supplying station auxiliary power to the power plants and switchyard.

In an area of tremendous generating capacity, Niagara Switchyard will be connected to the Niagara Mohawk and the Ontario Hydro systems. The addition of more than 2,000 Mva of generation there raised the question of the interrupting capabilities of present-day power circuit breakers. Network analyzer studies indicated that those used on the St. Lawrence Power Project would not meet the



between the two plants and the switchyard. Also indicated are the tie connections with stations of the St. Lawrence Power Project, Ontario Hydro, and Niagara Mohawk Power Corp. Lewiston will be largest hydro plant in hemisphere

interrupting requirements at Niagara Switchyard.

Manufacturers extended themselves to furnish 10,000-Mva, 115-kv oil circuit breakers for the St. Lawrence Project. The 15,000-Mva breakers for Niagara meant a new design which might take two years to develop. This time was not available in the project's accelerated program. Consequently, it became necessary to sectionalize the 115-kv buses at Niagara, as well as at Packard Station of Niagara Mohawk Power Corp.

But manufacturers agreed to furnish 230-kv breakers with an interrupting rating of 20,000 Mva, but could not supply air blast breakers.

Air Blast Type Likely

Preliminary plans for the EHV section of the switchyard call for two banks of 300-Mva autotransformers to step up the voltage from 240 to probably 360 kv. As the EHV tie line will have connections at load centers between the Niagara and Adirondack Stations, power circuit breakers will be installed on the high-voltage side. It now appears that the EHV circuit breakers for this tie line may be the air blast type after all, if the current transformer requirements can be met. Such breakers have since been introduced.

The main control room will be at the south end of the Lewiston Station, and all generators, as well as all high-voltage and 13.8-kv station service breakers, will be controlled from there. The operator there may select the method of starting as well as synchronizing.

Single-Phase Serves Residential

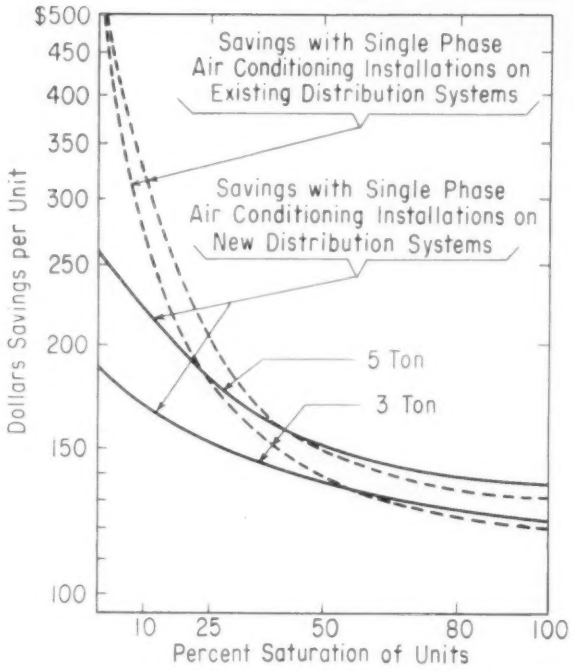


FIG 1—**CAPITAL INVESTMENT** savings in distribution plant go up when air conditioning service is single-phase

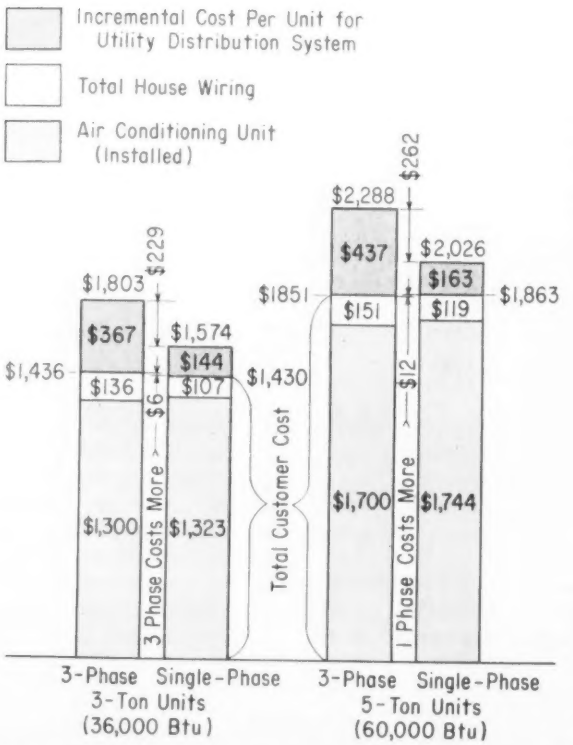


FIG 2—**OVERALL COST** of air conditioning, its supply are compared for 3-phase and single-phase distribution

Installed cost to customer, distribution system outlays favor it over 3-phase for 5-ton units in the Southwest, many studies show

BRYCE BRADY, BELA MOHR, EMIL F. BUETTNER, Oklahoma Gas & Electric Co, Oklahoma City, Okla

Growing saturation of air conditioning loads, particularly central systems, has brought many utilities face-to-face with the question: Should residential service be single or 3-phase? An analysis of the cost of serving, the cost of utilization equipment including wiring, and the quality of service shows that for all load densities up to 100% saturation single-phase is preferable. Furthermore, its continuity of service is superior and voltage flicker less.

Vast savings in distribution facilities can be realized by serving this load single phase. Cost to customers is slightly less too. Recognizing these facts, Oklahoma Gas & Electric Co has announced to customers a preference for single-phase equipment for motors in sizes up to and including 7½ hp and has presented information showing why customers should prefer such equipment.

Campaign Proceeds

A three-man team—head of the sales department and one member each of engineering and sales departments—is touring the company, visiting all divisions, and explaining the differences between single and 3-phase equipment so that they will be able to explain the company's attitude. Selected employees also are explaining the advantages of single-phase equipment to manufacturers, dealers, distributors, and builders. Company people are participating in meetings and discussions within the industry to encourage the use of single-phase equipment. A brochure entitled, "Here Is Your Best Bet in Residential Central Unit Air Conditioning" is being distributed.

The decision to a favor single-phase over 3-phase equipment in residential areas was made after a comprehensive engineering study begun in 1953 and completed in 1958. The merits of single-phase service became more apparent each year. The price differential has decreased each year and for some models has now disappeared.

The decisive factor was the fact that single-phase equipment is not only more economical but provides higher quality of service, i.e., single-phase motors are immune to voltage unbalance, cause less voltage flicker at starting, and are less vulnerable to service outages due to broken conductors and blown fuses.

A survey of 20 Southeast utilities in 1957, revealed that 17 render 3-phase service to residential central air conditioning loads and three single-phase service. It was found also, that of seven major utilities in Kansas, Missouri, Louisiana, Oklahoma, Texas and Arizona, four serve 3-phase air conditioners on request; two provide 3-phase if the home owner pays an extra

Air Conditioning Better, Cheaper

charge, and one does not render 3-phase service to residences.

Thus most utilities in the South, where residential air conditioning was first promoted, are rearranging old or building new residential distribution systems to give 3-phase service. Such developments are inconsistent with published studies and articles which show that single-phase is more economical.

Service Has Savings

A study, completed recently, proves that supplying service to residential air conditioning equipment by single-phase distribution systems results in large savings in capital investment and operating expense by OG&E. The study shows that with single-phase there is no penalty and some advantages to owners, manufacturers, and dealers.

OG&E has 270,000 residential customers. Central air conditioners have tripled in the past three years and more than doubled in the past two years. Saturation is now 1.36%. Sales forecasts indicate that within 10 years saturation will be 10%. There are also 44,000 customers with individual room conditioners. Saturation of both central and room conditioners is 17.25%. It is anticipated that saturation of residential air conditioning may approach 100%.

The correct method of serving this potentially large block of power should be adopted before saturation becomes significantly greater.

In the study, with 10% saturation of central air conditioning, the average additional investment in distribution facilities for supplying 3-phase service is about $236 per unit of 3- or 5-ton size. Even if saturation reaches 100%, the added investment for 3-phase service will be $126 per customer. In either case, the added cost would be appreciable for the individual company or on a national basis.

In making the study on relative merits of single-phase and 3-phase supply for residential air conditioning loads numerous factors were considered.

When installed in old homes, air conditioning equipment is purchased by the user. When installed in new homes the air conditioning equipment is purchased by the builders. Several surveys and local sales experience indicate that about half of the central air conditioning units sold go into old homes.

Influence Size

Several conditions influence the size of units and a number of factors indicate a trend toward smaller units, supported by:

1. An announcement by leading equipment manufacturers of an increase in motor compressor efficiencies in excess of 20%. This increase permits the use of smaller units. There will probably be further increases in efficiencies associated with compressor speeds of 3,600 rpm.

2. Some manufacturers use two motor compressors in each unit.

3. Many homes lend themselves to two small central

(*Continued on page 76*)

Table I—Utility Savings per Unit With Single-Phase Utilization at 10% Saturation of Residential Central Air Conditioning

	Investment Savings	Annual Oper. and Maint. Savings
Transformer stations	$121	$2.75
Primary conductor	7	0.00
Secondary conductor	8	0.06
Meters	45	2.25
Services	7	0.19
Capacitors	28	0.13
Extra engineering and administration	20	0.00
Total Per Unit	$236	$5.38

Table II—Additional Customer's Cost per Unit for Residential Central Air Condition with Single-Phase Utilization

	Investment Savings	Annual Maint. Cost
3-ton units	— $6.00*	$4.74
5-ton units	12.00	6.83
Average of 3-3 ton and 1-5 ton	— $1.50*	$5.26

* The minus sign signifies a larger cost for three-phase

Table III—Trend of Unit Price Differential

	Additional Price of Single-Phase Over Three-Phase for Air Conditioning and Heat Pump Equipment	
	3-hp Motors	5-hp Motors
1951	$88.00	$155.00
1954	43.00	78.00
1957	35.00	51.00
1958	23.00	44.00

Table IV—Average Electrical Characteristics of 1957 Models of Central Air Conditioning Equipment

Unit output (air-to-air)	3-Ton		5-Ton	
Phase	Single	Three	Single	Three
Compressor motor size (nom)	3-hp	3-hp	5-hp	5-hp
Volts	230	220	230	220
Starting Current (amp)	89	83	108	101
Starting kva	20.5	31.6	24.8	38.5
Starting pf	89%	63%	88%	61%
Running current (amp)	23.4	16.3	30.6	21.9
Running kva	5.4	6.2	7.0	8.3
Running pf	95%	82%	95%	84%

German Utility

McGraw-Hill World News — Bonn, Germany—Interest of a West German utility was instrumental in development and installation in Berlin of a unique high performance 110-kv 3-conductor low pressure oil-filled cable. Installed by Berliner Kraft und Licht AG (BEWAG) between Neukoelln and Columbia-Damm, the 2.36 mi. paper-insulated cable has its three conductors encased in an extruded and corrugated aluminum sheath. A polyvinyl chloride (PVC) jacket is extruded and bonded to the aluminum sheath in a vacuum.

BEWAG reportedly sought devel-

Handy Gauge Checks OCB Contacts

P. R. ILER, Maintenance Man, Substation Dept, Ohio Power Co, Lima, Ohio

A sliding gauge has been developed by Ohio Power Co to facilitate the often difficult problem of checking contact adjustments on oil circuit breakers. The gauge provides a written record of compression or wipe and uniformity of contact make between interrupters on the same pole unit and between pole units.

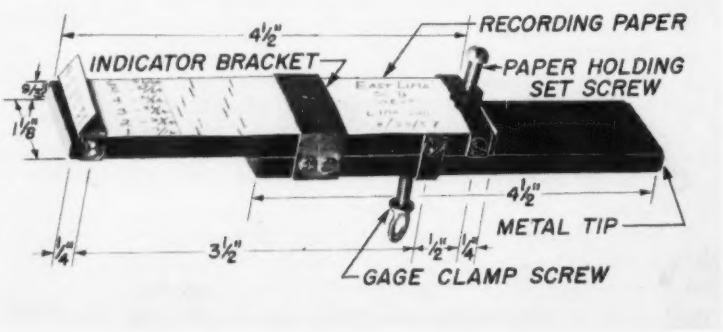
The gauge is constructed from two wood or plastic bars with metal tips. Four copper brackets are attached to permit sliding action and to support paper and set screws. The indicator bracket serves as a guide for scribing pencil marks.

Differences between interrupter positions are measured from convenient reference points. Contact compression, for example, can be read from movement between the crosshead and a point on the bottom of the interrupter.

The point of contact make is checked by connecting a continuity tester or ohmmeter between the crosshead on the lift rod and one interrupter. The gauge is inserted and expanded between the crosshead and the bottom of this interrupter. This position is marked by a pencil dash along the gauge indicator bracket. The ohmmeter is then successively connected to each of the other interrupters.

At the position of each lift rod corresponding to each contact make, the gauge is expanded or contracted to fit snugly. Corresponding gauge positions are again marked by pencil dashes. Distances between different pencil marks indicate adjustments that are necessary to obtain simultaneous contact make within permissible tolerances.

Compression or wipe is checked by making marks on the gauge as before, but with the breaker closed and the weight of the contact on the latch. The distance between corresponding "make" and "latch" marks is equal to the contact wipe.



Installs Aluminum-Sheath Cable

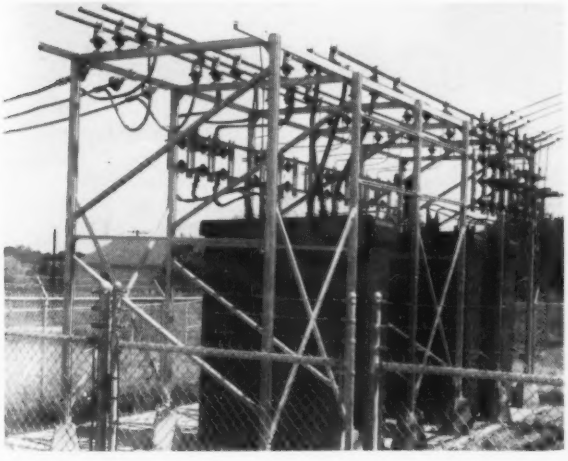
opment of the cable on grounds of economy and to reduce telephone interference. The German engineers estimate, on the basis of constant copper prices, that the cost of the new 3-conductor cable is 60% of the three single-conductor cables it installed in 1952.

Formerly, BEWAG relied exclusively on high-pressure oil-filled cables for 115 kv. Single-conductor cables with and without sheathing were installed. In 1956, single-conductor cables without lead sheathing were installed with conductors forming a triangle. Losses were 6%. Also in 1956, BEWAG put in 3-conductor high-pressure oil-filled cable with lead sheath and armoring. Sheath and armor losses were 9%.

The most recent lines, laid in 1957, are of two different special designs. One is a 3-conductor, oval conductor, high-pressure oil-filled cable with lead sheath and armoring. The other is the 3-conductor, low-pressure corrugated aluminum sheath cable mentioned above. BEWAG found that the cost per cable-mile of both types is about the same and that sheath and armor losses are about 9% for both.

The new low-pressure installation consists of ten sections of about equal length. At the Neukoelln end, cable was split by a distribution head and brought into a newly-erected substation through single-conductor terminals. At the Columbia-Damm end, the aluminum-sheathed cable is joined to a 3-conductor oil-filled lead sheathed cable by three single-conductor stop joints with separation boxes.

The manufacturer claims that differences in sheath loss between lead and aluminum 3-conductor cable are insignificant. Corrugation adds to the cost by increasing cable size and oil tank capacity, but this is compensated by rigidity.



Special Members Cut Structure Cost

R. VAN SLEEN*, Director, Utilities Dept, Gastonia, N. C.

The use of special structural members in the construction of an open-type substation has reduced costs for Gastonia, N. C., Electric Dept. The savings resulted from reduced labor and engineering time, which more than offset the higher cost of the members.

In planning this station, conventional cubicle-type enclosed outdoor switchgear was first considered. However, initial cost was considered high, and the proposed installation lacked flexibility for future changes. Even if changes could be made, their cost would be high, and the work would have to be done with equipment de-energized.

The simple open-type structure with a conventional transfer bus was then investigated. This structure is not so neat in appearance and is much more difficult for an unskilled crew to erect. However, the layout is more flexible, and modifications can be made without interrupting load.

A check of construction methods revealed that savings in labor would result by using a patented structural member. This member is shaped so that a special nut can be positioned at any point along the member and secured by tightening a screw.

Company personnel had used these members previously in constructing a cable-reel rack. The ease and speed of erecting the rack was a point favoring use of the members for the substation. Other advantages are that the proper length members can be factory galvanized and require no punching or drilling in the field, even though minor changes might be necessary. Also, detailed drawings showing hole locations, etc, were not required, thus reducing engineering time.

The structure is made of the same basic-unit member used in five different arrangements. Erection required 4 hr by a line crew of five men. Additional time was required to mount all components and wiring, but the total labor cost was less than anticipated.

*—Since submitting this article, the author has accepted a position as Superintendent, Utilities Dept, Shelby, N. C.

Single Shell Contains Heaters

"K" Heater, new regenerative feedwater heating system, brings nearer power production at lowest possible plant cost

FRANK P. WITMER JR, Mechanical Engineer, Kuljian Corp, Philadelphia, Pa.

The "K" Heater, a new type regenerative feedwater heating system for which Kuljian Corp has applied for patents, is factory-built and tested as a single unit, and combines the functions of separate closed heaters normally used in a feedwater heating cycle. It is an integral arrangement of several closed shell-and-tube-type heaters in series, enclosed within a single vertical cylindrical shell. It is adaptable to any number of extraction heating stages.

Thus, the "K" Heater combines separate functions for handling by integrated units and eliminates unnecessary components. It represents a long stride toward the production of power at the lowest possible cost.

For a typical 150-Mw installation, with 1,000,000 lb evaporation per hr at 2,000 psig and 1,050F, 1,000F reheat, the unit has eight extraction heating stages. Its size is about 10 ft in dia by 56 ft high, this tower-like structure mounted on the condenser floor as close as possible to the turbine. Its prime components are the turbine, condenser, "K" Heater, boiler, condensate pump, drip pump, and boiler feed pump.

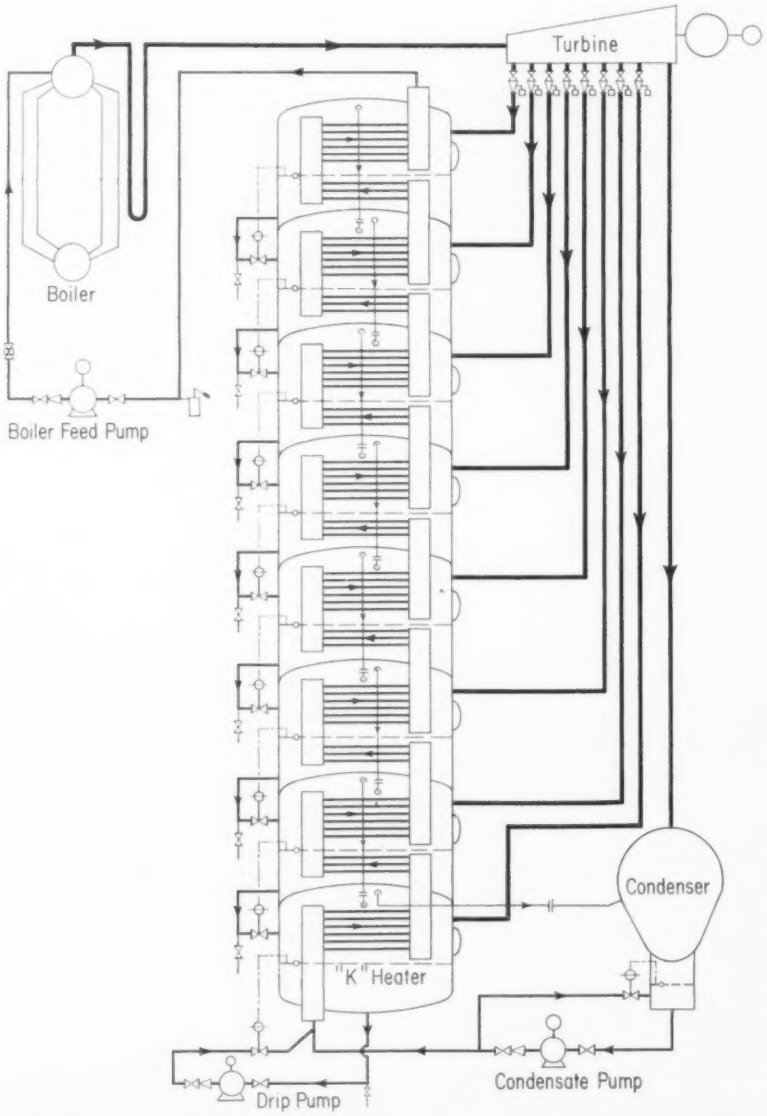
Feedwater is pumped from the condenser hotwell directly to the "K" Heater, entering the inlet manifold at the bottom and passing through tubes in the condensing zone of the lowest pressure compartment. Entering the next manifold, it passes through tubes in the drain cooling zone of the next higher pressure stage. In the following manifold, it is elevated further and and passes through the condensing zone of the same pressure stage. This process continues through progressively higher pressure stages until the feedwater finally emerges from the highest pressure stage at the top and, entering the boiler feed pump, is discharged directly to the boiler.

Turbine extraction steam enters the "K" Heater at various elevations, depending on its pressure, the highest pressure steam being supplied to the top compartment. By making multiple passes over the feedwater tubes, steam is first desuperheated, then condensed, and finally, as condensate, sub-cooled, in zones for each of these operations.

The sub-cooled condensate is cascaded to the condensing zone of the next lower pressure stage, proper condensate levels being maintained throughout the unit by a level control valve at each stage.

Vents are cascaded through orifices and carried from the lowest stage into the main condenser. Condensate drained from the lowest pressure stage may be returned to

(*Continued on page* 47)



SCHEMATIC shows integrated arrangement of shell-and-tube-type heaters in series within single enclosing vertical cylinder shell, as seen in photographs

We invite you to LIFT the curtain as

Pennsylvania Transformer introduces a new distribution regulator...

Combining . . . for the *first* time . . . 2 outstanding Pennsylvania products:

❶

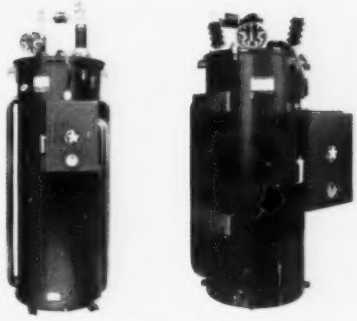
Patented Pole Star distribution transformer—with exclusive lap-on-top core

❷

Pennsylvania's load tap changing mechanism—proved in years of power-transformer service

plus

Mor-Amp feature to increase regulating capacity to 160% of rated current at reduced range



STATION TYPE POLE TYPE

THE POLE STAR REGULATOR

available now in

27 single-phase

distribution ratings

VOLTAGE RATINGS: 2500, 5000, 7620, 13800, 14400

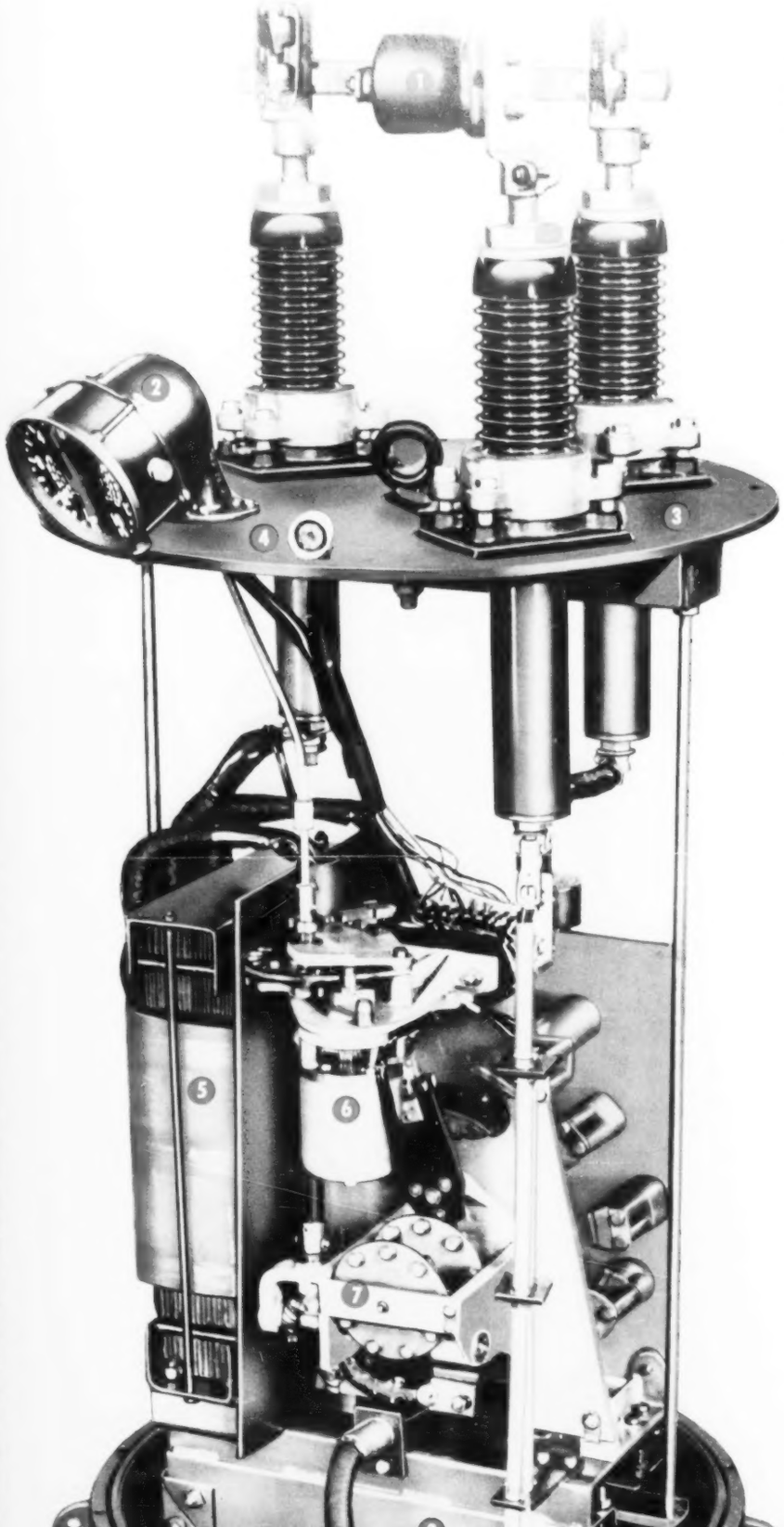
CURRENT RATINGS: 15 THROUGH 668 AMPERES

Designed for:
POLE MOUNTING
PLATFORM MOUNTING
STATION INSTALLATION
providing Pole Star reliability

plus

the advantages of efficient, economical voltage regulation in 32 steps of 5/8%

PENNSYLVANIA TRANSFORMER DIVISION
McGRAW-EDISON COMPANY
CANONSBURG, PENNSYLVANIA



FEATURES tell the story of the new Pennsylvania Pole Star Regulator ... designed to help your customers LIVE BETTER ELECTRICALLY

1. **Lightning protection** for the series winding is provided by a valve-type arrester.

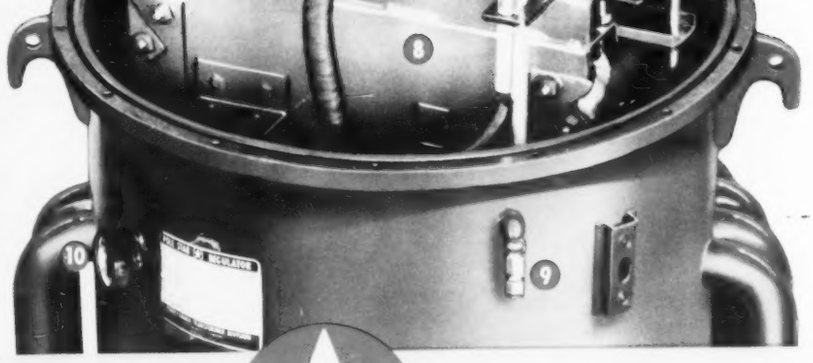
2. **Cover location of position indicator** precludes all possibility of misalignment if unit is untanked for tap changer tests or inspection. Dial is tilted for easy reading.

3. **Unit construction** of internal assembly, cover, and cover accessories greatly simplifies periodic untanking for inspection.

4. **Standard jack plug** on cover connects controls to regulating mechanism. This simplifies relocation of control cabinet.

5. **Bridging reactor** prevents voltage interruptions and dips during tap changes.

6. **Direct-drive tap changing mechanism** gives the Pole Star Regulator many of the service-proved principles of Pennsylvania's power transformer load tap changers. Standard on all Pole Star Regulators rated 13800 and 14400 volts or with current rating from 321 to 668 amperes, the direct-drive tap changer is equipped with a revers-



668 amperes, the direct-drive tap changer is equipped with a reversible, single-phase, capacitor-type motor.

7. **Positive mechanical interlocking** is assured by direct drive of contacts by means of a scroll cam and index plates. Flat-velocity switch speed reduces arcing and prevents contact erosion.

THE POLE STAR REGULATOR

8. **Pole Star Distribution Transformer core-and-coil assembly** is used in all Pole Star Regulators. This includes patented lap-on-top core, which has established unexcelled records for low exciting current, low core loss, uniform quality.

9. **Screened uni-directional breather** allows for expansion of oil, prevents entrance of moisture or foreign matter.

10. **Oil-level gauge** is standard on all units.

11. **Control cabinet** may be easily removed for relocation at bottom of pole or elsewhere.

12. **Main panel is hinged** for easy access to fuse, arrester, potential transformer.

13. **Easy-to-grip control knobs** save operator's time and temper. Calibrations are large, can be checked at a glance.

14. **Tubes provide high cooling capacity.** Ends are expanded against openings in tank wall to assure tight fit, then are welded inside the tank.

15. **Structural steel base** on station-type units. Pole-type units have hold-down lugs for platform mounting, as well as hanger brackets.

PENNSYLVANIA POLE STAR REGULATOR
Station-type, with Direct-drive Tap Changer

Pole-Type and Station-Type . . .

NEW PENNSYLVANIA POLE STAR REGULATOR offers performance-proved reliability in all single-phase distribution sizes

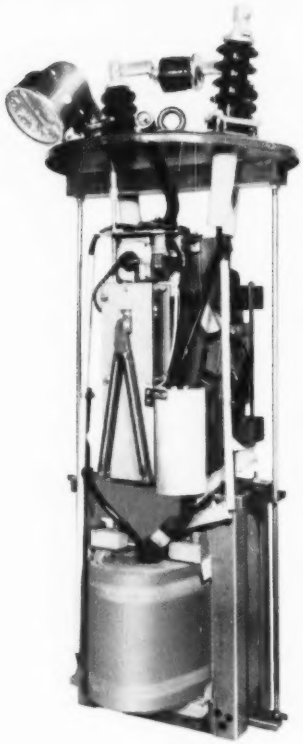
Although new in itself, the single-phase Pole Star Regulator is a product of Pennsylvania Transformer's highly successful, long-term experience in two related fields: distribution transformers and power-transformer load tap changers. As a result, Pennsylvania is able to introduce the Pole Star Regulator in a *complete range of distribution sizes* (a total of 27 different ratings) . . . and with design and construction features that point to economical, sustained performance in *pole-top, platform and station installations.*

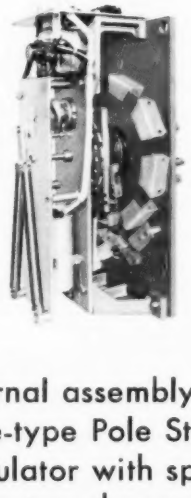
10% Regulation in 32 Steps of 5/8%

The features described elsewhere on these pages are yours with the time-proved advantages of 32-step regulation. Voltage is efficiently controlled in 5/8% steps over a range of plus or minus 10%. The normal operating band is plus or minus 1 volt, with a time delay of 10 seconds to avoid unnecessary changes. Both the operating band and time delay can be varied to fit local conditions.

Light in Weight, Easy to Handle

Throughout the entire range of sizes, the Pole Star Regulator offers size and weight advantages that mean easier handling . . . faster, more economical installations. Specific details are given in Bulletin PSR-958. For a copy—or a quotation on your next regulator requirements—write to Pennsylvania Transformer Division, McGraw-Edison Company, Canonsburg, Pa.





POLE STAR

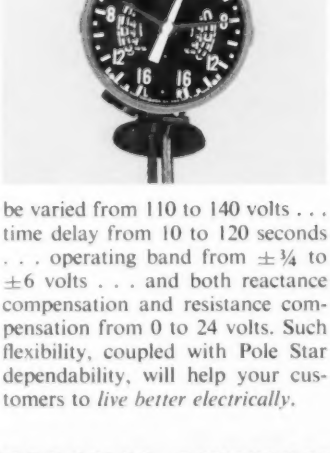
EASY-TO-ADJUST

MOR AMP FEATURE

and other convenient controls give maximum flexibility

Controls for the Mor-Amp feature —which permit regulating capacity to be increased to as much as 160% of rated current—are located on each side of the position indicator. Separate scales for "raise" and "lower" Mor-Amp settings are located on the face of the dial.

Mor-Amp is one of many easy-to-use adjustment features that permit wide flexibility in the use of Pole Star Regulators. Voltage level can



be varied from 110 to 140 volts . . . time delay from 10 to 120 seconds . . . operating band from ±¾ to ±6 volts . . . and both reactance compensation and resistance compensation from 0 to 24 volts. Such flexibility, coupled with Pole Star dependability, will help your customers to *live better electrically.*

Internal assembly of pole-type Pole Star Regulator with spring-drive tap changer

Design and construction details for the pole-type Pole Star Regulator are essentially the same as for the station-type regulator shown on the inside fold. For units rated 7620 volts and below and with current ratings 320 amperes and below, the high-speed, arc-resisting tap changer shown here is used.

A single-phase, reversible-drive motor loads tension springs that provide energy for the rapid switching action. Tap position is accurately shown by the position indicator at all times, with no chance of misalignment.

PENNSYLVANIA TRANSFORMER DIVISION
McGRAW-EDISON COMPANY
CANONSBURG, PA. • Greater Pittsburgh District

McGRAW EDISON

Single Shell Contains Heaters (*Continued from page* 42)

the "K" Heater by means of a drip pump to save heat, or may be rejected to the condenser.

The "K" Heater's cylindrical shell is partitioned horizontally into pressure compartments, one for each extraction stage. Each compartment has an access manhole. Partitions consist of torispherical heads, convex side up. Net effective pressure is on the convex side. The top head is ellipsoidal, designed for maximum extraction pressure. Head and shell thicknesses vary throughout the height for different pressures and loads.

Feedwater piping in de-superheating and condensing zones consist of groups of closely spaced paralleled tube groups, arranged horizontally in re-entrant hairpin bends. Tubes enter and leave the circular heater space tangentially via internal vertical manifolds next to the heater shell.

This arrangement distributes tube surface effectively within the circular heater cross-section. Total length of each tube group, number of tubes per group, and number of tube rows vertically are designed for optimum feedwater velocity and heat transfer surface area in the de-superheating and condensing zones of each pressure stage.

Expanded and Welded

Feedwater piping in the drain cooling zones takes a slightly different geometrical pattern. Channels of circulating condensate surround tube groups arranged in a modified form of multiple horizontal hairpin bends. Total length of each tube group, number of tubes per group, and vertical number of tube rows are calculated for proper feedwater velocity and heating surface.

Each feedwater tube is expanded and welded to vertical manifold pipes at the entrance and exit of its pressure compartment. These manifold pipes extend vertically through two adjacent pressure stages, each serving as exit manifold for the lower pressure stage and inlet manifold for the higher. Manifolds are internal and welded for support at only one elevation to allow free expansion of both manifolds and tubes. In fabrication, the manifold pipe may be split longitudinally to afford access for expanding and welding the tubes in place. After the assembled manifold is welded together, access to tube ends is through handholes.

Tubes in the de-superheating and condensing zones are supported by intermittent horizontal spiders and connecting support bars. In drain cooling zones spacer bars, tack welded to the compartment walls, are the support.

Extraction steam enters the "K" Heater through the inlet opening in the shell of the appropriate compartment. High pressure steam passes initially through a de-superheating zone, a constricted passage for producing the proper mass velocity of steam passing counter-flow over the feedwater tubes. Length of the de-superheating zone is such as to remove 70 to 85% of the total superheat in the steam, the amount depending on steam inlet conditions. In the eight-stage unit, de-superheating is undertaken in the four highest pressure stages.

Passes Over Tube Bundle

De-superheated, or lower pressure inlet steam coming directly from the turbine enters the condensing zone of its proper compartment and passes over the bundle of tubes there. Drains from the next higher pressure compartment are flashed through the drain control valve and added to this steam quantity.

After giving up its latent heat of vaporization, condensate deposited in this zone is trapped and fed to the drain cooling zone in the lowest section of its pressure compartment. There the condensate is sub-cooled by circulating in channels surrounding the hairpin-shaped feedwater tube groups. The cross-section of these channels ensures proper condensate velocity, the condensate flowing counter to the feedwater.

From the drain cooling zone, drains are passed through the drain control valve to the next lower pressure compartment or, when already in the lowest compartment, are withdrawn from the heater.

Cycle efficiencies obtained with the "K" Heater compare favorably with those obtained in conventional regenerative cycles. The "K" Heater maintains energy at the highest possible temperature level by means of the de-superheating and drain cooling zones. In drain cooling, the entering feedwater absorbs heat from the leaving condensate before it is flashed to the next lower pressure heater. Feedwater is thus raised a few degrees more than would have been possible from the same amount of heat in the lower pressure heater. Moreover, the leaving feedwater absorbs heat from the incoming steam in the de-superheating zone that raises feedwater temperature to a point above the saturation temperature corresponding to steam inlet pressure.

An obvious advantage of the "K" Heater is simplification of the piping arrangement. The usual interconnecting lines between separate heaters for carrying feedwater, cascading drains, and vents are eliminated. Instead of having to reach a number of separate heater locations, the turbine extraction lines are simple risers to various elevations of the adjacent "K" Heater. The saving can be measured in lower installation and maintenance costs of pipe, fittings, and insulation. There are other savings through the elimination of pipe hangers and valve supports and through the reduction of pressure and heat losses from pipe friction and radiation.

Takes Less Floor Space

Furthermore, the single vertical "K" Heater takes much less floor space than a multiplicity of separate heaters with their interconnecting piping. This saving, together with that obtained through the elimination of individual heater foundations, affects a considerable part of the building costs.

To obtain proper advantage of the "K" Heater's integrated cycle, a deaerating type condenser must be used, make-up being added at the condenser. This would make practicable the elimination of any separate evaporator and deaerating heater.

As the boiler feed pump is at the high temperature phase of the cycle and its suction head must be supplied by the condensate pump, the condensate pump must have a booster stage to produce the required suction head and compensate for all friction losses through the "K" Heater.

But the additional cost of the special condensate pump is partly

(*Continued on page* 70)

Enter The Aluminum Transformer

Joint development by transformer manufacturers and aluminum producers brings prototype all-aluminum transformers

Early commercial availability of all-aluminum distribution, network and power transformers is clearly forseeable in the recent "unveiling" of prototype designs. They are the joint development of three transformer manufacturers and two aluminum producers.

Moloney Electric Co, St. Louis, and Aluminum Co of America, Pittsburgh, have cooperated in development of three units—a distribution transformer, a network transformer case, and a power transformer.

Precision Transformer Co, Chicago, and Kaiser Aluminum & Chemical Corp, Chicago, have cooperated in developing distribution transformers.

General Electric Co, Pittsfield, Mass., and Aluminum Co of America, have developed a 115-kv power transformer.

• The three Moloney-Alcoa units will be shown in New York the week of February 1-6, in conjunction with the Mid-Winter General Meeting of the American Institute of Electrical Engineers.

The all-aluminum distribution transformer is rated at 25 kva. Its coil is wound with aluminum foil strip conductor. Aluminum structural members support the coil in its all-aluminum outer tank. See Fig 1.

Manufacture of the distribution transformer was one phase of a developmental order issued to Moloney by Nantahala Power & Light Co, an Alcoa subsidiary. The order is for a total of 50 transformers, ranging from 5 to 50 kva, to be delivered for installation in the Nantahala system in 1959.

A network transformer case made of Alcoa 6061 aluminum alloy is a prototype tank for a 500-kva unit. It represents reportedly an optimum design from the standpoint of maintenance and cooling characteristics. The corrugated design feature replaces the usual transformer radiator tubes. See Fig 2.

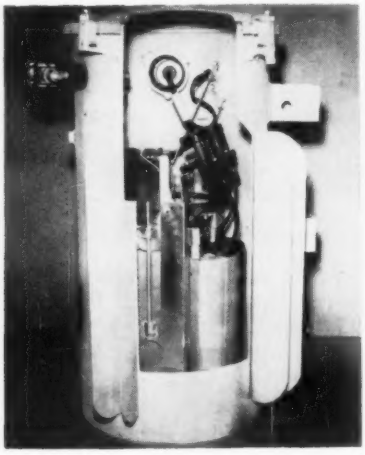
The prototype power transformer (Fig 3) uses aluminum for all metal parts except magnetic core and trucks. Tank and structural members are aluminum; coil windings are aluminum wire; radiation is accomplished with aluminum extruded finned tubes.

This model is built to standard 3750-kva transformer design specifications. Use of finned tubes, along with the high heat transfer properties of the light metal, provides a theoretical thermal capacity for this transformer of about 6,000 kva, some 60% better than the design. Ultimately it will serve a hydraulic extrusion press at the Lafayette (Ind.) works of Alcoa.

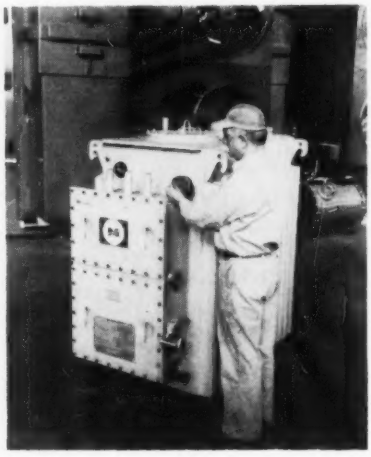
• The Precision-Kaiser distribution transformers use aluminum tank and components.

The tank (Fig 4) is designed for

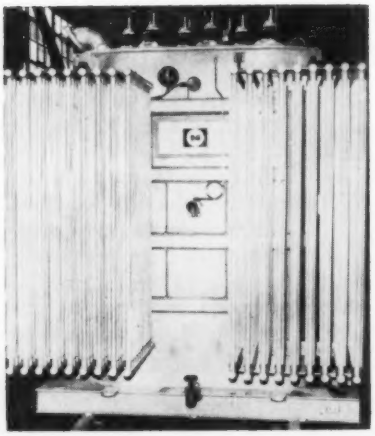
(*Continued on page* 51)



1. 25-Kva Transformer



2. Network Transformer



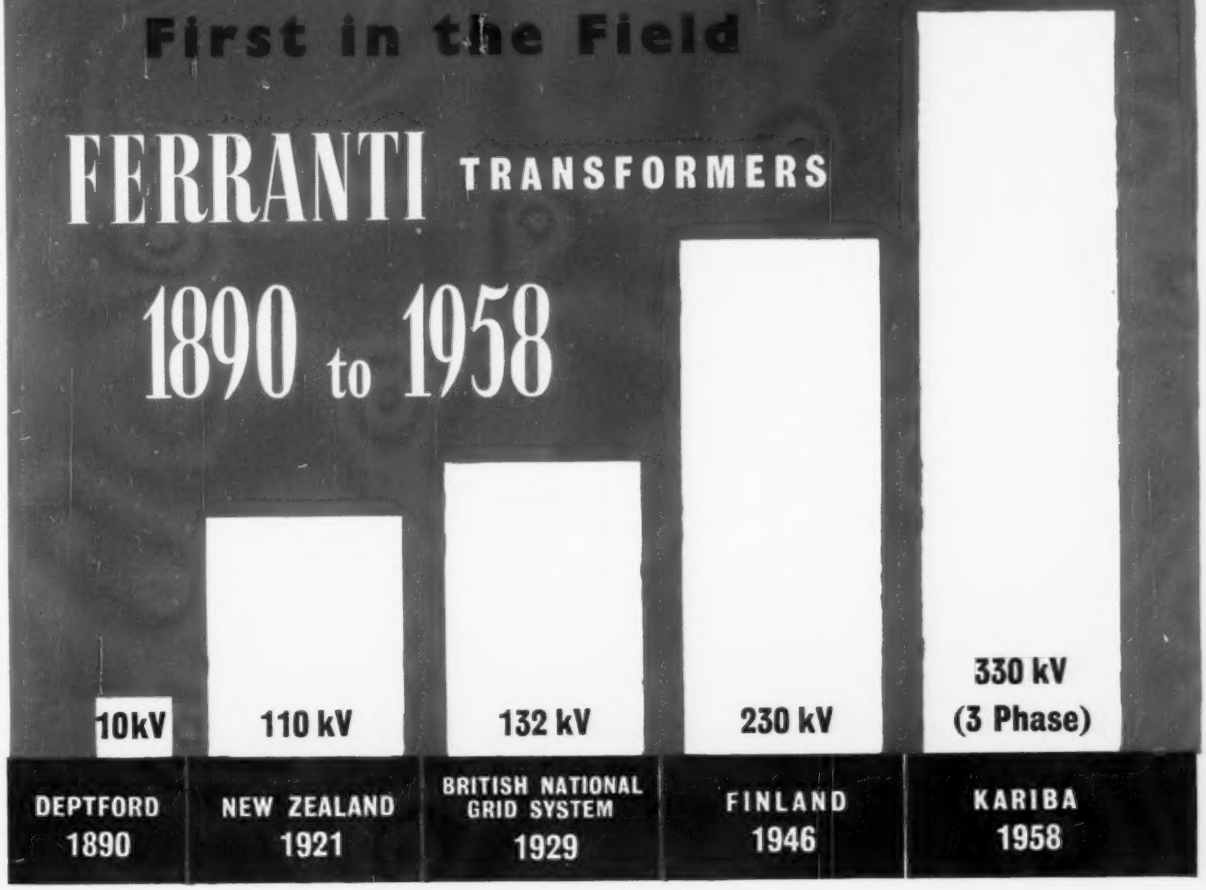
3. 3750-Kva Transformer

4. 167-Kva Transformer

First in the Field

FERRANTI TRANSFORMERS

1890 to 1958



In the British Electrical Industry, Ferranti transformers are always first in the field thus satisfying the ever increasing demand for electric power.

The skill of Ferranti engineers over a period of more than 65 years has resulted in the award of contracts for the supply of transformers of the highest voltage and rating for the world's largest electric power projects.

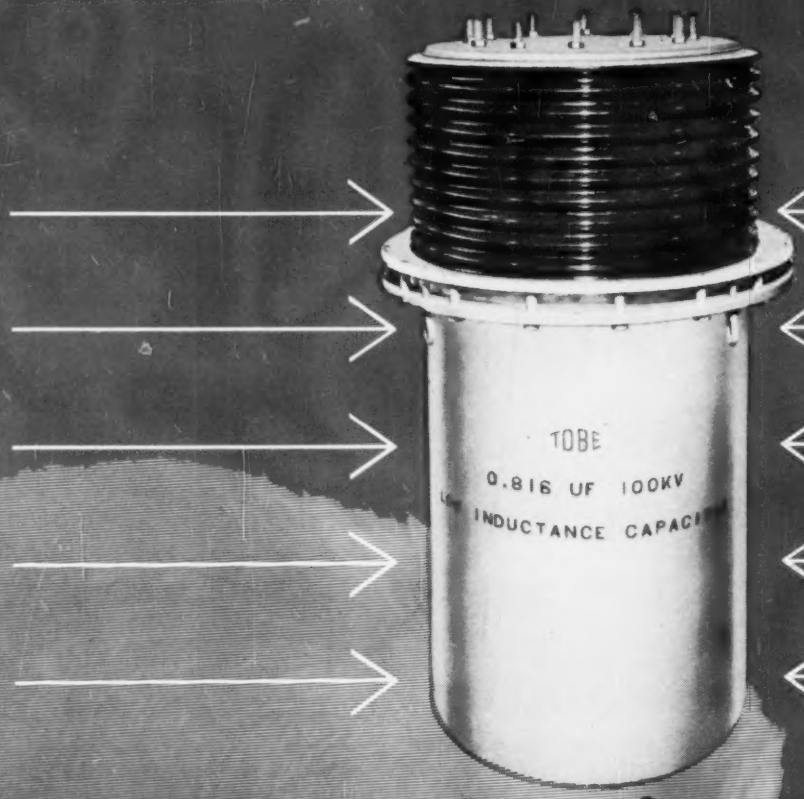
Specify **FERRANTI** *transformers famous throughout the world*

FERRANTI LTD

Head Office: HOLLINWOOD · LANCS · ENGLAND
London Office: KERN HOUSE · 36 KINGSWAY · W.C.2
NEW YORK: Ferranti Electric Inc., 30 Rockefeller Plaza, N.Y. 20
TORONTO: Ferranti Electric Ltd., Mount Dennis, Toronto 15

PLANTS
MOSTON: Manchester 10, England
WYTHENSHAWE: Manchester 22, England
WEST GORTON: Manchester 12, England
GEM MILL: Chadderton, Lancs., England
EDINBURGH: Ferry Road, Edinburgh 5, Scotland
DUNDEE: Kings Cross Road, Dundee, Scotland

Expressly Designed for
University of California
Los Alamos Scientific Laboratory
Los Alamos, New Mexico



creative engineering

(NUCLEAR DIVISION)

Tobe NRG-200 Series Energy-Storage Capacitor

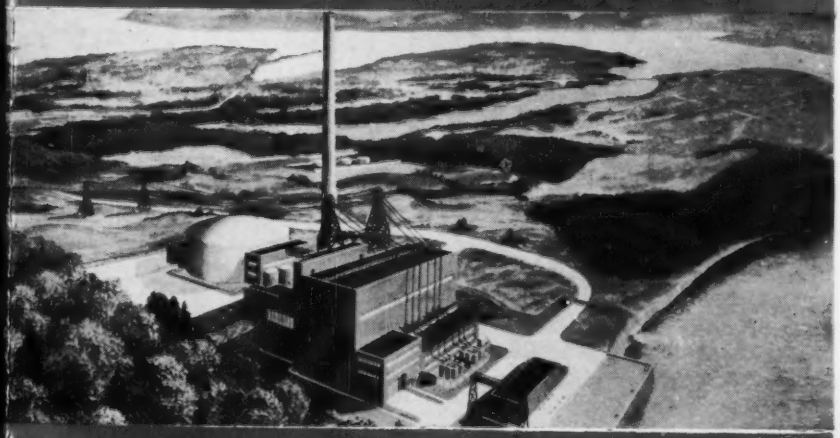
BUILDING CAPACITORS that can develop a peak surge of 20,000 megawatts takes intimate knowledge of capacitor physics and capacitor manufacture. Security regulations prevent our detailing the many projects in which Tobe is pioneering in the exacting area of thermonuclear energy-storage capacitors. (Utility research engineers are now investigating the thermonuclear "pinch" technique as a possible source for continuous electric power.)

Tobe 50 KVAR Power Capacitor

It was Tobe's long experience in building power capacitors that made it possible for us to develop capacitors capable of handling unprecedented peak loads. So, whether you need a bank of 50 KVAR's—or a bank of thermonuclear energy storage capacitors – talk to Tobe.

Tobe Deutschmann Corporation, Norwood, Massachusetts.

in action



THE "FUTURE" IS HERE...in this architect's rendering of the Indian Point, N. Y. nuclear power plant now being erected on the Hudson River 40 miles north of New York, by Consolidated Edison.

TOBE TEMPALL CAPACITORS

Since 1932 persistent research, trustworthy engineering, rigid production standards.

Aluminum Transformers

(*Continued from page* 48)

167-kva transformers and was fabricated by Shaw-Perkins Mfg Co, Philadelphia. It is made from Kaiser's 5052 weldable aluminum alloy with 6061 alloy for fittings.

Reducing overall transformer weight by 180 lb is one advantage of Precision's all-aluminum cooling tank with radiators. The one-third weight saving over conventional steel tanks is a step toward replacing pole-suspended smaller 100-kva transformers with 167-kva units without reinforcing the supports.

The unit will be exhibited at the 1959 Public Power Association convention in Seattle, Wash., on May 15, 16, and 17.

• The GE-Alcoa transformer, rated 20,000 kva, 115-13.8/6.9 kv, is believed to be the largest built to date with all electrical and structural parts made of aluminum. It has aluminum foil in the winding and has aluminum core clamps, tank and cooling radiators. Magnetic and insulating parts are conventional—steel, insulation, and oil.

Use of aluminum foil for windings gives better transient voltage characteristics, reduced space factor, and lower heat loss, according to GE engineers. Aluminum in tank and structural parts reduces overall weight.

This GE power transformer will be installed in a substation at Alcoa's Massena, N. Y., Works.

Power Up Program to be Expanded by Westinghouse

Plans for an expanded Power Up program for 1959 were announced recently by Westinghouse Electric Corp. In addition to the wide range of activities already in use, this year's program will include Power Up clinics designed for specific industries. The first three clinics will be aimed at the petroleum, chemical, and paper industries. Three more programs are in the planning stages and others will be added from time to time.

The clinics will enable Westinghouse and utility sales departments to present Power Up programs tailored to the specific needs of each industry.

(*More Manufacturers News p,* 52)

For the long haul

guy with

CF&I GALVANIZED STEEL STRAND

Stringing lines over woodlands or difficult terrain is an expensive initial operation. But maintainance, too, can be costly unless the guy and messenger wires have the strength to withstand severe storms and the corrosion-resistance to assure long, trouble-free service.

To meet these requirements, CF&I carefully controls every step in drawing, galvanizing and stranding its Galvanized Steel Strand. Extreme care in cleaning and galvanizing produces a heavy, tightly-bonded coating of pure zinc that provides maximum protection against corrosion. CF&I Strand meets or exceeds ASTM Specifications A-122 or A-363, or can be made to meet customer specifications in seven- and three-wire constructions.

Your nearest Electrical Wholesaler or CF&I representative will give you full details. Call him today.

CF&I GALVANIZED STEEL STRAND
THE COLORADO FUEL AND IRON CORPORATION

5800

Albuquerque • Amarillo • Atlanta • Billings • Boise • Boston • Buffalo • Butte • Chicago • Denver • Detroit • El Paso
Ft. Worth • Houston • Kansas City • Lincoln (Neb.) • Los Angeles • New Orleans • New York • Oakland • Oklahoma City
Philadelphia • Phoenix • Portland • Pueblo • Salt Lake City • San Francisco • San Leandro • Seattle • Spokane • Wichita

Four Buildings Increase Output of Subox Paints

Subox, Inc has taken possession of the last of four new buildings erected at its Fairmount Plant in Hackensack, N. J. The new additions on the two-acre site bring the plant area to a total of 40,000 sq ft and triples the manufacturing capacity of metal protective paint.

The recent additions are indicative of the company's growth in 10 years since the move from its pilot plant operation. That earlier move to its present location increased by about four times the size needed for the company's production.

E. T. Eberhardt, the founder of Subox, Inc, is president and chairman of the board, and his son, T. J. Eberhardt, is executive vice president.

DID YOU KNOW . . .

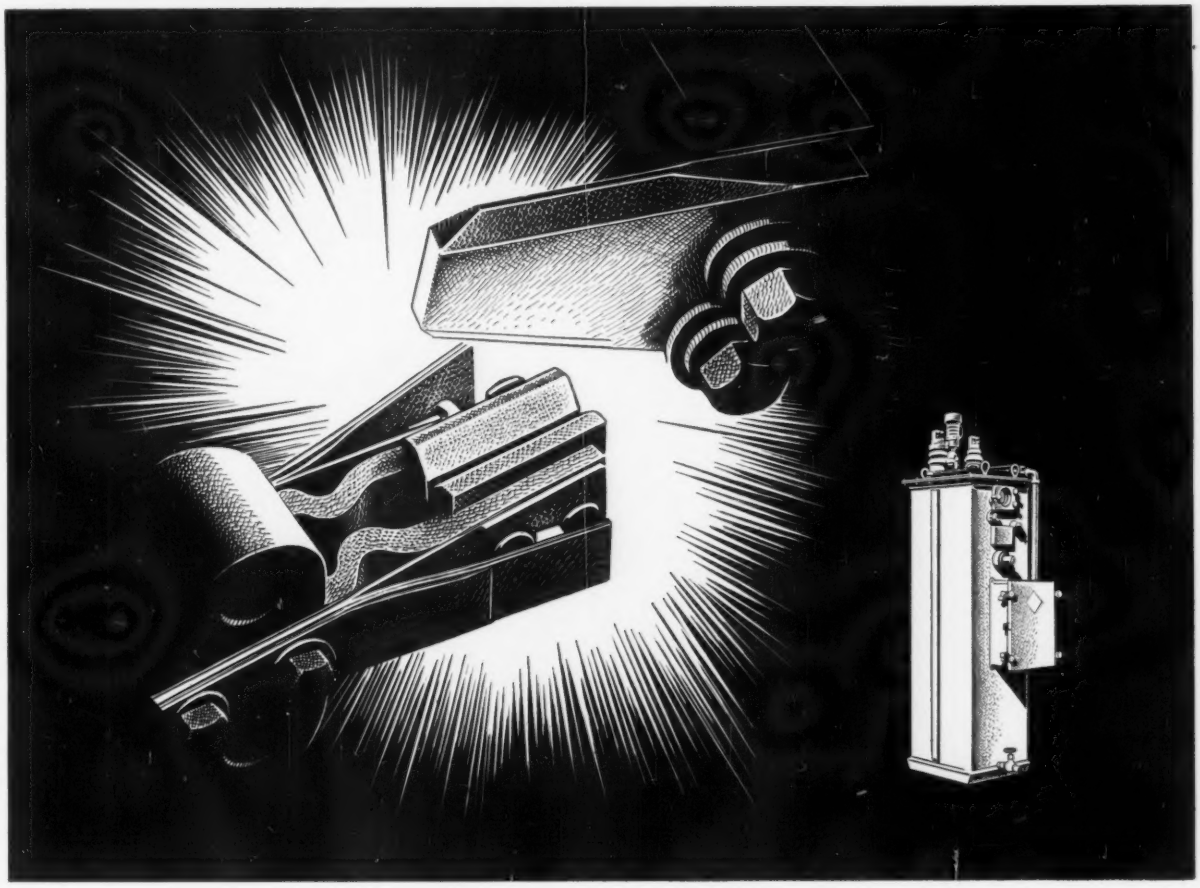
. . . a new standard line of power transformers to be introduced by Kuhlman Electric Co, in ratings 501 through 10,000 kva, 69 kv and below, has a notable reduction in weight and dimensions. An example—a 5,000-kva, 43.8-7.2-kv unit weighs 38,600 lb, compared to 41,400 lb for the previous design. Dimensions are—height over bushings 157 in., width including radiators 124 in., and depth 106 in., compared with 165, 135 and 135 in. respectively.

. . . higher lumen ratings are now available for two popular sizes of fluorescent lamps produced by Sylvania Electric Products Inc. Over 75 lumens per watt are obtainable in standard 8-ft, 75-w lamps, and over 70 lumens per watt in 4 ft, 40-w lamps.

Schwager-Wood to Build Oerlikon Designed Breakers

Schwager-Wood Corp, Portland, Ore., has been licensed by Oerlikon Engineering Co, Zurich, Switzerland, to build oil circuit breakers based on Oerlikon designs. Schwager-Wood receives drawings, patterns, tools, and equipment from United Power Control Corp of Tacoma, Wash.—formerly Pacific Oerlikon Co—and can use the Zurich

(*Continued on page* 54)



Top Performance Comes "Built-In" When You Specify Mallory Contacts

Contacts play an important role in modern electrical gear such as circuit breakers, motor controllers, and voltage regulators. To be sure of top performance in the equipment you buy, it pays to specify Mallory Elkonite® contacts.

Long experience in the specialized science of contact design and manufacturing goes into Elkonite contacts. The combination of density, hardness, micro-structure, resistance to arc erosion, mechanical strength, and other vital characteristics is selected to match the requirements of each application. The particle size of the refractory constituent and processing technique are carefully controlled to produce the characteristics required by the finished contacts.

For many years, Mallory has engineered and supplied contacts for leading manufacturers of switchgear. Be sure that the manufacturer from whom you buy uses Mallory Elkonite contacts. They're your assurance of lasting and dependable performance . . . and they're the hallmark of value-minded design.

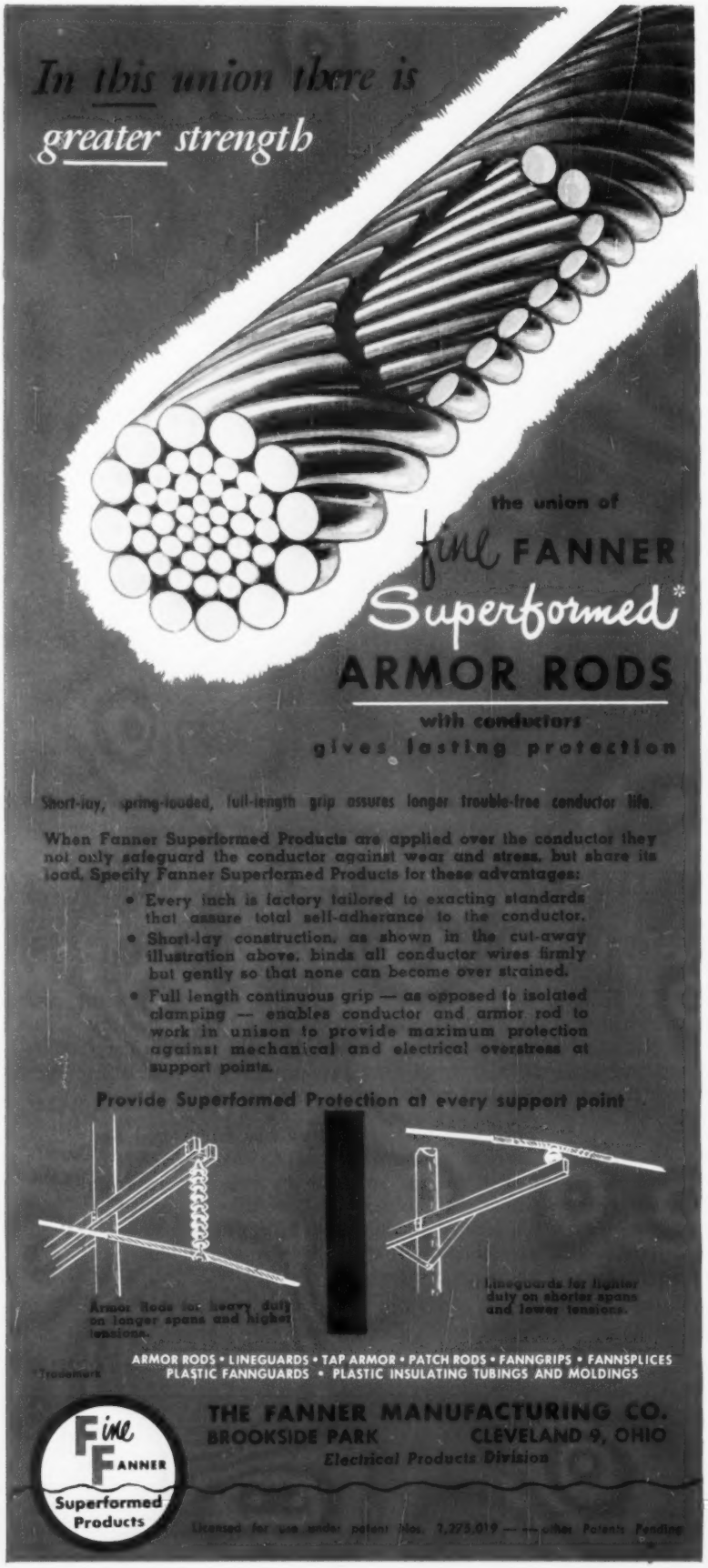
Serving Industry with These Products:

Electromechanical—Resistors • Switches • Tuning Devices • Vibrators
Electrochemical—Capacitors • Mercury and Zinc-Carbon Batteries
Metallurgical—Contacts • Special Metals • Welding Materials

Expect more . . . get more from

P. R. MALLORY & CO. Inc.
MALLORY

P. R. MALLORY & CO. Inc., INDIANAPOLIS 6, INDIANA


In this union there is greater strength
the union of
fine FANNER
Superformed*
ARMOR RODS
with conductors
gives lasting protection
Short-lay, spring-loaded, full-length grip assures longer trouble-free conductor life.
When Fanner Superformed Products are applied over the conductor they not only safeguard the conductor against wear and stress, but share its load. Specify Fanner Superformed Products for these advantages:
• Every inch is factory tailored to exacting standards that assure total self-adherance to the conductor.
• Short-lay construction, as shown in the cut-away illustration above, binds all conductor wires firmly but gently so that none can become over strained.
• Full length continuous grip — as opposed to isolated clamping — enables conductor and armor rod to work in unison to provide maximum protection against mechanical and electrical overstress at support points.
Provide Superformed Protection at every support point
Armor Rods for heavy duty on longer spans and higher tensions.
Lineguards for lighter duty on shorter spans and lower tensions.
ARMOR RODS • LINEGUARDS • TAP ARMOR • PATCH RODS • FANNGRIPS • FANNSPLICES
PLASTIC FANNGUARDS • PLASTIC INSULATING TUBINGS AND MOLDINGS
*Trademark
THE FANNER MANUFACTURING CO.
BROOKSIDE PARK CLEVELAND 9, OHIO
Electrical Products Division
Fine Fanner Superformed Products
Licensed for use under patent Nos. 2,275,019 — other Patents Pending

Schwager-Wood

(*Continued from page 52*)

high power testing laboratory for new designs and future developments. The corporation will service all equipment, made by Oerlikon or its subsidiaries, sold in U. S.

Schwager-Wood will enter the breaker field with an initial offering of 69-kv breakers, 600 and 1,200 amp, up to 1,500-Mva, IC, 5 cycles. These breakers will incorporate a newly designed, compressed air mechanism suitable for high speed reclosing duty.

MANUFACTURERS BRIEFS

Combustion Engineering Inc, New York, filed a registration statement with Securities and Exchange Commission relating to the acquisition of General Nuclear Engineering Corp through an exchange of stock. General Nuclear will be operated as a subsidiary. Dr. Walter Zinn will be in charge of Combustion's nuclear power activities.

Sylvania Electric Products, Inc designated Feb. 11, 1959, as the date for its share owners to vote on a proposed merger into General Telephone Corp. The plan would involve the issuance of one share of General Telephone common stock for each share of Sylvania common.

Thomas Industries, Louisville, Ky., acquires Benjamin Electric Mfg Co, Des Plaines, Ill. Stockholders of both companies approved the purchase late last month.

Preformed Line Products Co, Cleveland, O., has acquired from Industrial Rubber and Plastic Co, Cleveland, facilities for neoprene dipping and plastic coating. Preformed products which are used primarily to attach and support covered power and telephone conductors. The move, according to President Thomas F. Peterson, Sr., will permit full-time use of coating equipment. This speeds production and increases output of coated dead-ends, tangent supports, lashing rods, spacers, armor rods and line guards, as well as advances pole-line accessories now in the development stage.

SAFETY SWITCHES STAND UP UNDER 100,000 AMPERE SHORT CIRCUIT TEST!

INDEPENDENT TESTING LAB RELEASES FINDINGS AFTER GRUELLING "TORTURE RACK" TESTS

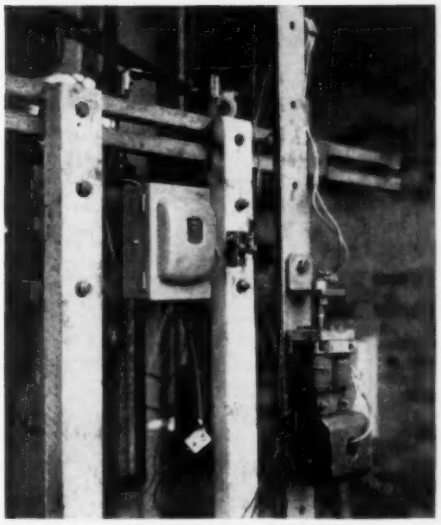
Unprecedented tests have been completed on 30 through 600 ampere rated Square D safety switches equipped with high capacity current limiting fuses. During these tests, switches were closed on a short circuit system delivering up to 100,000 amperes (symmetrical—R.M.S.). In addition, the fault was applied on the closed switches. *All switches withstood the shocks without any sign of failure!*

High Capacity Systems Demand Stamina

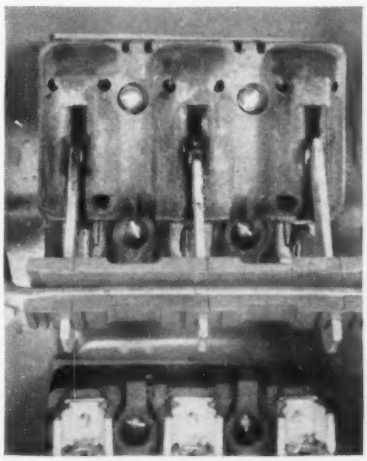
High capacity systems capable of delivering tremendous short circuits are becoming more and more prevalent with the growth of electrical loads. Network systems in metropolitan areas are a source of such faults. Another, the heavy industrial areas, with a concentration of sub-stations and rotating machinery. Terrific stresses and heat generated by such faults are serious hazards to both personnel and equipment unless properly contained. That is why proven protection for switching service and feeder circuits is of major concern.

Square D Standard Switches Do The Job

These tests offer conclusive proof that standard Square D Type HD and Type ND switches, equipped with high capacity current limiting fuses, can be used on such systems without fear of failure. You pay no premium for the proven performance they offer. Why settle for less?



Square D switch on "torture rack" during test involving up to 100,000 ampere short circuit



SUMMARY TABLE • Extract from Report No. S/NA R66—Sheet No. 5

Ampere Rating	Voltage Rating	Catalog Number	Average Symmetrical Prospective Current R.M.S.	Recovery Voltage R.M.S.	Maximum Total Arcing Time	Fuse Type
30	250	A85351	96,600	252	.0009	A2Y-30A
30	250	A85351	96,400	253	.0010	FRN-30A
30	600	A85341	107,000	590	.0020	A6Y-30A
30	600	A85341	106,000	601	.0027	FRS-30A
60	250	A86352	96,400	248	.0010	A2Y-60A
60	250	A86352	95,200	252	.0019	FRN-60A
60	600	A86342	106,000	605	.0011	A6Y-60A
60	600	A86342	108,000	598	.0020	FRS-60A
60	600	A86342	107,000	601	.0013	NAS-60A
100	250	A86353	95,200	253	.0009	A2Y-100A
100	600	A86343	108,000	604	.0014	A6Y-100A
200	250	A86354	95,200	253	.0037	A2Y-200A
200	600	A86344	107,000	602	.0011	A6Y-200A
400	250	A86355	95,900	252	.0039	A2Y-400A
400	600	A86345	106,000	611	.0050	A6Y-400A
600	250	A86356	94,500	251	.0062	A2Y-600A
600	600	A86346	107,000	601	.0062	A6Y-600A

Above • Extract of Nelson High Power Laboratory Report C/NA-66

At left • No sign of failure in this switch interior after 100,000 ampere short circuit test

SQUARE D SAFETY SWITCHES GIVE YOU *Certified* PERFORMANCE!

SQUARE D VISIBLE BLADES you can SEE you're safe!

EC&M HEAVY INDUSTRY ELECTRICAL EQUIPMENT...NOW A PART OF THE SQUARE D LINE

SQUARE D COMPANY

Service Area . . .

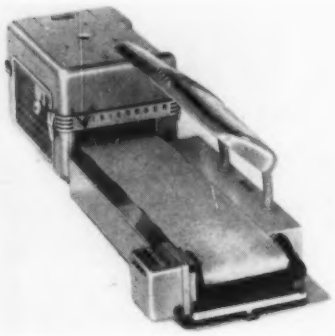
. . . is an integral part of Shelterfor-M switchgear structure. It is obtained by extending the end enclosure of the Shelterfor-M housing. Standard 3-ft sections provide flexibility, and no center supports are needed for extension widths up to 9 ft. The service area eliminates the need for a separate structure.
Westinghouse Electric Corp, Box 2278, Pittsburgh 30, Pa.

Power Transformers . . .

. . . in a new line feature rectangular sealed tanks with compact round cooling tubes. ASA ratings range from 501 through 10,000 kva, single or 3-phase, 69 kv and below. From 5 to 10% reduction in weight has been obtained. Standard accessories are more conveniently grouped for use of operating personnel. Smaller core and coil units of greater efficiency and extra protection around line leads are other features. A self-aligning, double-contact tap changer that locks in position is provided.
Kuhlman Electric Co, Birmingham, Mich.

Diesel Generators . . .

. . . are available in eight models from 50 to 200 kw. All models operate at 1,800 rpm. Each is directly connected to a single-bearing, 4-pole, revolving field alternator. Stable operating conditions are established within 2 sec following any sudden change in load between no load and full load.
D. W. Onan & Sons Inc, Minneapolis, Minn.



Oscillograph . . .

. . . provides legible records of electrical phenomena in a few seconds. The Model 906 Visicorders with latensifier attachments record up to 14 channels of data at frequencies from dc to 5,000 cps. The latensifier connects to the Visicorder for power and is equipped with a receptacle for remote operation of both units.
Minneapolis-Honeywell Regulator Co, Heiland Div, 5200 E Evans Ave, Denver 22, Colo.

Stacking Accessory . . .

. . . adds lift truck and stacking facilities to standard mobile hydraulic cranes. Known as the Stack-or-Lift, the device is designed to eliminate the need for overhead cranes and lift trucks where the latter are uneconomical for general purpose lifting, stacking and transporting. Fork widths adjust to fit most pallets.
Ruger Equipment, Inc, 198 W Fourth St, Uhrichsville, Ohio.

Storage Battery . . .

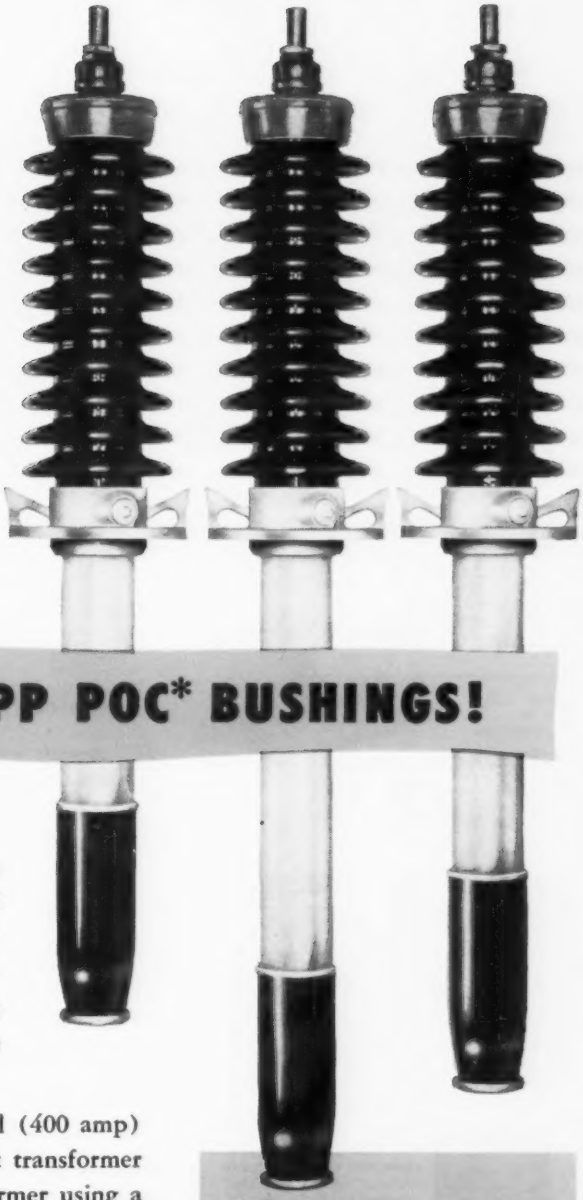
. . . has replaceable cells held in place by shock-resistant "snap-on" frames. Any voltage or amperage may be set up by adding or removing cells. Individual cells can be replaced in case of cell failure.
Scranton Cellomatic Battery Corp, Archbald, Pa.

Fire Extinguishers . . .

. . . are available in dry chemical portable models in 2½ and 5-lb sizes. They put out as much fire

(*Continued on page* 58)

You can replace *any* draw-lead bushing on your 69 kv system



with one of these LAPP POC* BUSHINGS!

Here's a real saving for you in simplification of warehouse inventories and reduction of costs! No matter how many types of transformers may be on your system . . . no matter how old they may be . . . any bushing replacement requirement can be met by the Lapp POC* ASA Standard bushing.

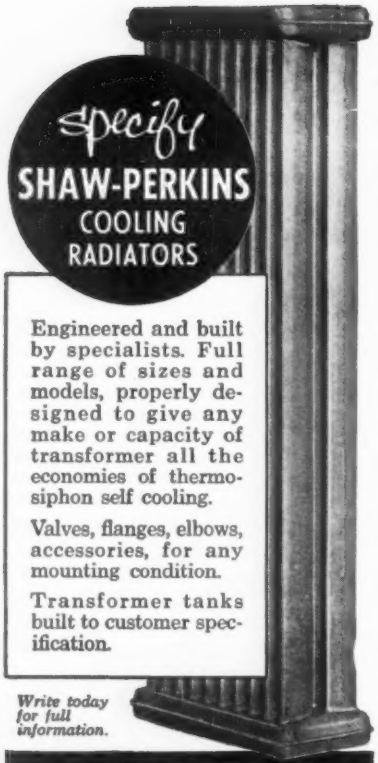
At 69 kv, for example, the Lapp POC* draw-lead (400 amp) bushing is made in just three shank lengths. Present transformer designs call for these bushings. On any older transformer using a pre-standard bushing, one of these will also fit perfectly; all that is required is a simple flange adapter which provides for differences in mounting details, and for length and clearances.

Lapp can supply POC* Bushings for your stand-by stocks in voltage ratings 15 kv to 161 kv. Also, we'll design and supply, at nominal cost, non-magnetic flange adapters which will adapt these ASA Standard bushings to every transformer on your system. Give us data on the transformer bushings you now have in service. Let us show you the economies you can effect by reducing your entire stock of spare bushings to the required sizes of Lapp POC* Bushings and a suitable assortment of flange adapters. You'll never be without the replacement bushing you need, and you will save spectacularly in warehouse space . . . in stock maintenance labor costs . . . in investment in inventory. Lapp Insulator Co., Inc., Le Roy, New York.

Lapp

POC* BUSHING

*PAPER-OIL CONDENSER TYPE
TOTALLY-ENCLOSED CORE
ASA STANDARD


specify
SHAW-PERKINS
COOLING
RADIATORS
Engineered and built by specialists. Full range of sizes and models, properly designed to give any make or capacity of transformer all the economies of thermo-siphon self cooling.
Valves, flanges, elbows, accessories, for any mounting condition.
Transformer tanks built to customer specification.
Write today for full information.
SHAW-PERKINS
MANUFACTURING COMPANY
201 East Carson St · Pittsburgh 19, Pa.

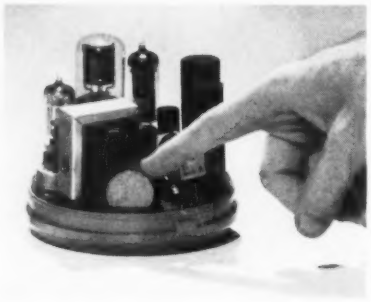
Headquarters for
HIGH POTENTIAL
Testing
Every over-potential test need from the generator to the appliance motor . . . is met by a HYPOT®
150 KV Testing
Mobile HYPOT®
Non-destructive testing of power cables, generators, and insulators with AC or DC test potentials to 150 KV. New DC Mobile HYPOT® is easier to handle, cuts costs. Write for bulletin "Mobile HYPOT®".
30 KV Testing
Bench HYPOT®
Models available with AC or DC test potentials from 5 to 30 KV. Widely used for insulation testing of cables, distribution equipment and heavy duty motors.
10 KV Testing
Portable HYPOT Jr.®
The advanced over-potential tester that enables anyone to make high potential breakdown tests. Separate lights indicate excess leakage current and insulation breakdown. Available with test voltages from 1500 v a-c to 10000 v a-c.
10-35, 10
Write Today
ASSOCIATED RESEARCH, Incorporated
3760 W. Belmont Avenue • Chicago 18, Illinois

Fire Extinguishers . . .

(*Continued from page 56*)

as eight and sixteen carbon tetrachloride portables respectively. Pressure gauges are recessed in the housing for added protection. Operating pressures are from 110 to 180 psi.

Walter Kidde & Co, Inc, 675 Main St, Belleville 9, N. J.



Photoelectric Control . . .

. . . mounts with plug-in, twistlock arrangement on all lighting hoods meeting NEMA-EEI standards. A Thyrite element is provided for protection against surges induced by lightning or line crossovers. The controller is only 4 in. high and 3½ in. in diameter.

General Electric Co, Schnectady 5, N. Y.

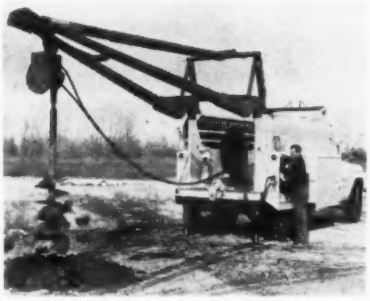
Cable Tray System . . .

. . . is available in aluminum extrusions or roll formed steel channels. The system is designed for electrical continuity as well as for mechanical strength. Trays are made with 4-in. deep sides, with cross rungs spaced at 9-in. intervals set at the bottom. Six standard widths from 6 through 24 in. are offered, and a wide variety of horizontal and vertical bends and other fittings are also available.

Husky Products, Inc, 5300 Vine St, Cincinnati 17, Ohio.

Hydraulic Digger . . .

. . . digs holes up to 10 ft in depth and 20 in. diameter in practically any type of soil. The Series DF-1



"Earth-Master" is designed for use with a "live-boom" derrick. Power is derived from a hydraulic pump driven by a power take-off installed on the truck transmission. Full-torque drive is available as optional equipment. Augers are available in sizes from 9 to 20 in. diameter.

McCabe-Powers Body Co, 5900 N Broadway, St. Louis 15, Mo.

Tool Compartments . . .

. . . are designed for universal mounting on any pickup truck or flat bed vehicle. Known as series TC, the tool compartments are available in two sizes; Model TC-72 for ½-ton and Model TC-84 for ¾-ton pickup trucks. The compartments are fabricated from heavy gauge steel.

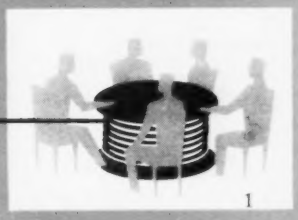
Utility Body Co, 1530 Wood St, Oakland 7, Cal.

Mobile Field Office . . .

. . . may be moved quickly to any job location. Channel-edged steel siding is factory bonderized and zinc coated for weather protection. Floor measurements are 7 ft 4 in. wide and 10 ft 4 in. long. Wheels are easily removed, and the office will withstand 100 mph winds when properly braced. High-speed wheels are equipped with 1-in. axle and tapered roller bearings.

Burlington Mfg Co, Burlington, Iowa

WIRE AND CABLE ROUND TABLE



Rockbestos reduces control cable size with Du Pont ALATHON® and ZYTEL®

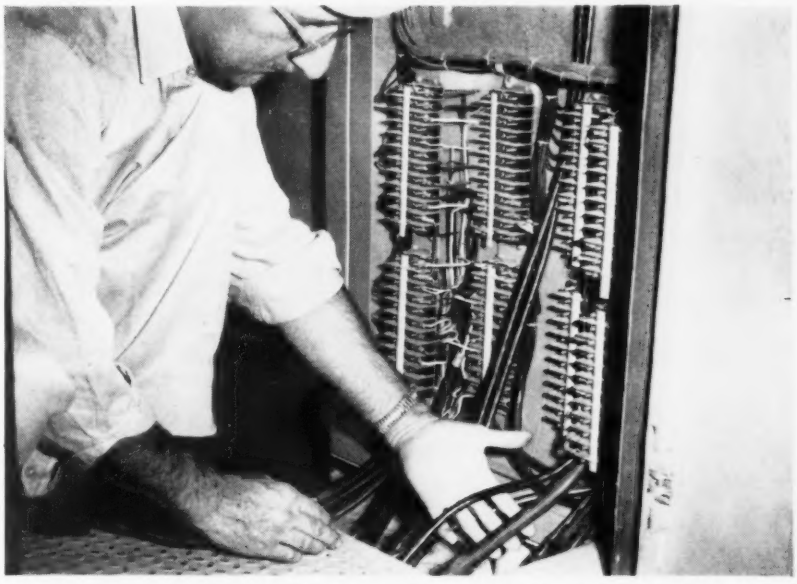
POLYETHYLENE RESIN NYLON RESIN

A drastic reduction in control cable size is made possible by combining a Du Pont ALATHON polyethylene resin with a ZYTEL nylon resin. The Rockbestos Products Corporation, of New Haven, Connecticut, proved this in the control cable they supplied for the Consumers Power Company's Justin R. Whiting plant in Erie, Michigan. This plant was designed by Commonwealth Associates of Jackson, Michigan.

The superior dielectric performance of ALATHON permits a primary insulation wall thickness of only .015" to .030". As a secondary insulation, a thin skin of ZYTEL imparts exceptional abrasion resistance. Wear from flexing at contact areas between primary insulation need no longer be an important consideration. ZYTEL also permits an increase in operating temperature limit and cuts down failure due to rough handling at termination points.

As the outer jacket, ALATHON withstands environmental stress cracking, corrosive environments, abrasion and, sometimes, weathering. The high molecular weight and well-dispersed carbon of ALATHON 4 make it particularly outstanding for jackets.

Because of the outstanding properties of these two plastics, much thinner layers are required to stay within safety requirements. Thus, many more conductors can be installed in existing conduits by replacing old cable with these smaller-diameter cables.



Electrician compares two different three-conductor control cables. Cable at left has primary and secondary insulation and jacket of ALATHON and ZYTEL; cable at right uses rubber.

SEND FOR FREE BOOKLET—For a complete report on the use of ALATHON and ZYTEL for improving plastic signal and control cable design, write for Polychemicals Department Booklet WC-3. Just clip the Round Table symbol from the top of this page and send it, along with your name and address, to the Du Pont Company, Rm. ZA 17119, Polychemicals Department, Wilmington 98, Delaware. *In Canada*: Du Pont of Canada Limited, P. O. Box 660, Montreal, Quebec.

POLYCHEMICALS DEPARTMENT

DU PONT

Better Things for Better Living . . . *through Chemistry*

ALATHON® POLYETHYLENE RESINS / RULAN® FLAME RETARDANT PLASTICS / ZYTEL® NYLON RESINS

Reader Service

For additional information on new products, supplies, and services in this issue, the Manufacturers Editor of Electrical World offers his facilities. Check items in which you are interested in list below:

NEW EQUIPMENT

Westinghouse .....Service Area ☐
Kuhlman .....Transformers ☐
Onan .....Generators ☐
Minneapolis-
Honeywell .....Oscillograph ☐
Ruger .....Stack-or-Lift ☐
Scranton Cellomatic.....Battery ☐
Kidde .....Fire Extinguishers ☐
GE .....Control ☐
Husky .....Cable System ☐
McCabe-Powers .....Digger ☐
Utility Body...Tool Compartments ☐
Burlington .....Field Office ☐

OTHER

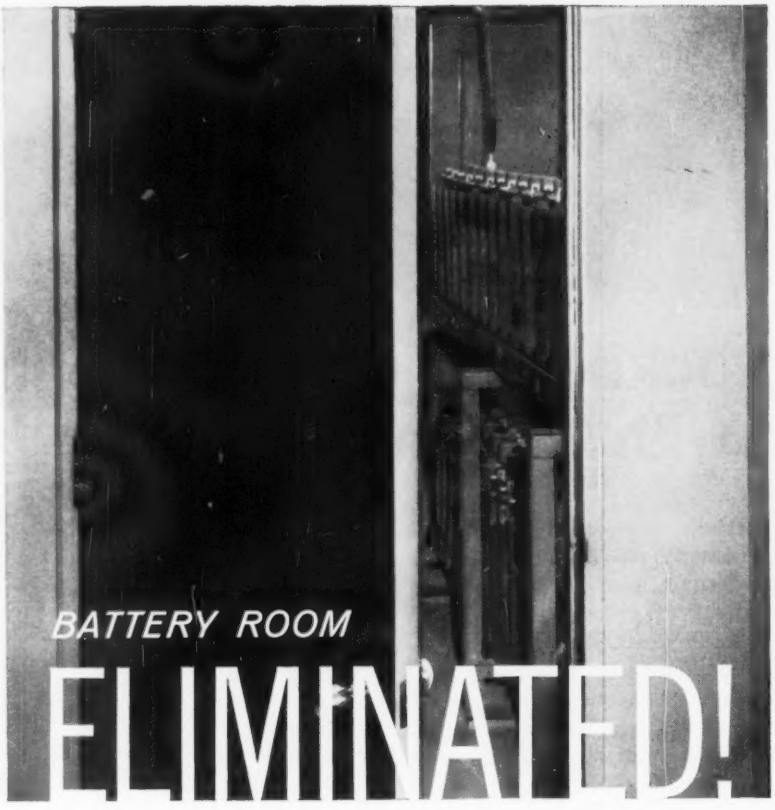
Manufacturers Editor
Electrical World
330 W. 42nd St.
New York 36, N.Y.

* Note: Requests must be received within four weeks of publication date, accompanied by complete information specified. This service cannot be offered to readers in foreign countries or to competitive manufacturers.

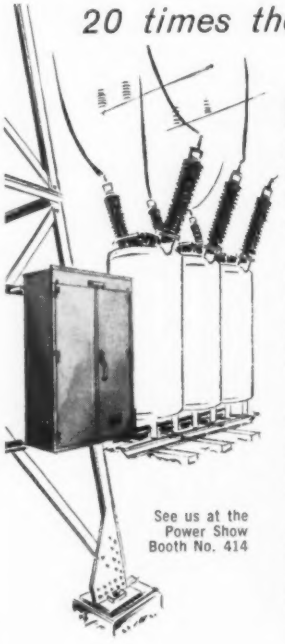
NAME_____
TITLE_____
DEPT._____
COMPANY_____
ADDRESS_____

FOR:
Reference ..... ☐
Specs ..... ☐
Trial ..... ☐
Purchase ..... ☐

JANUARY 19, 1959



Non-gassing Gulton Power Units deliver
20 times the punch, take 1/20 the space



POWERED by the world famous Voltabloc *sealed* nickel cadmium battery, the Gulton Power Unit delivers the punch needed for closing and tripping breakers and switchgear—yet takes only a fraction of the space needed by other DC Sources.

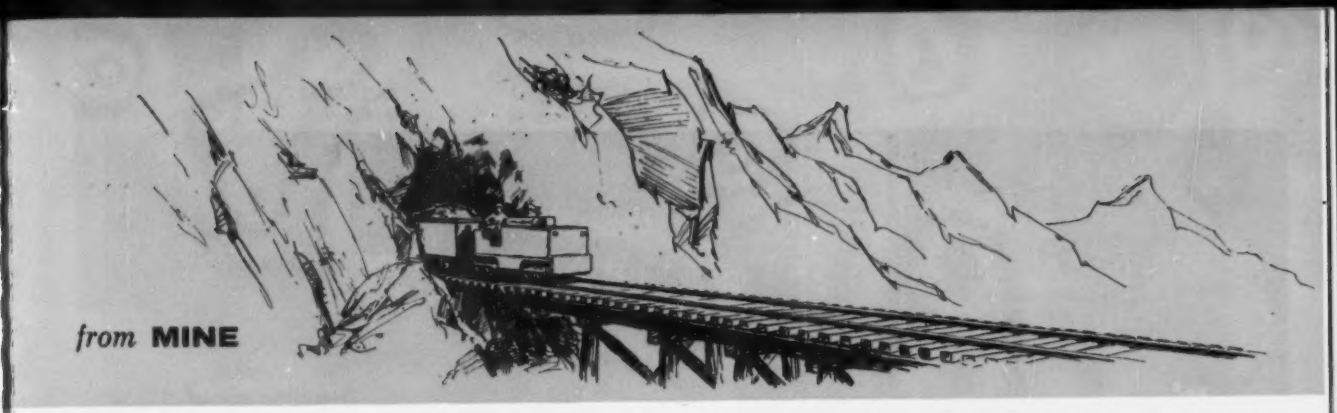
Reason for this is the patented sintered plate construction of the sealed Voltabloc battery and its compact specially designed automatic charger. Not only do these give the Gulton Power Unit exceptional electrical characteristics, but they provide additional benefits as well.

Maintenance, for example, and installation costs are eliminated. Since Gulton units are non-gassing as well as small in size, they can be installed right next to equipment with a minimum of wiring—sometimes even within it!

Our field engineers will be happy to help you pick the right unit for the job. For more information on how "BC" Power Units can help save space, maintenance and money—write for Bulletin No. GPU.

ALKALINE BATTERY DIVISION
Gulton Industries, Inc.
Metuchen, New Jersey

Gi



ONE SURE SOURCE OF SUPPLY

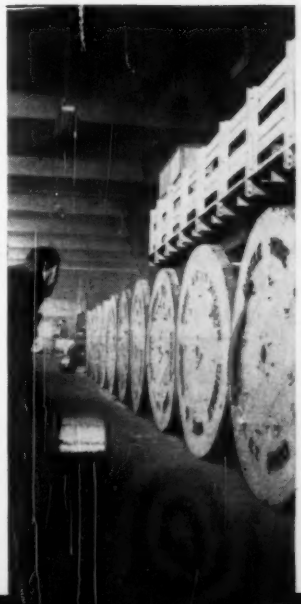
for all your wire and cable needs

Working through a Circle distributor is good business for wire and cable users. Reasons: quality products, reliability of supply, all-out service.

Take *quality*, for example! It's a built-in plus in every Circle product—from the basic metals mined and refined by Circle's own parent company, Cerro de Pasco, right down to the finished wire and cable—all the result of a business philosophy of producing products which far surpass minimum requirements.

The same goes for supply and service. Circle users know that nearby completely stocked warehouses can usually take care of their needs. And when they can't, they know a simple telephone call by their distributor to the plant will get the fast action they want.

So why don't *you* make a Circle distributor your "one sure source of supply"—many other satisfied customers do.



CIRCLE **WIRE & CABLE**
a subsidiary of
CERRO DE PASCO CORPORATION

PLANTS: Maspeth and Hicksville, N. Y. **SALES OFFICES & WAREHOUSES:** In all principal cities

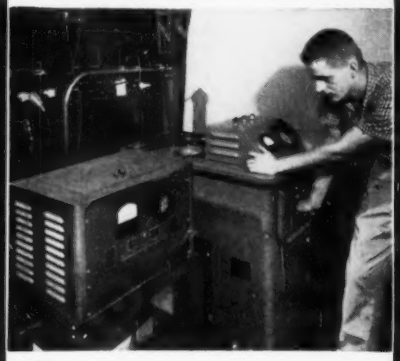
RUBBER COVERED WIRES & CABLES • VARNISHED CAMBRIC CABLES • PLASTIC INSULATED CABLES
NEOPRENE SHEATHED CABLES • "CIRTUBE" EMT

1 RATIO AND POLARITY TEST. The standard ASA ratio test to which we subject the coil and taps of every Delta-Star Distribution Transformer determines the precise turn ratio of primary and secondary windings, and can detect even a single-turn error. Polarity is checked at same time.

2 EXCITATION-LOSS AND IMPEDANCE TEST. On instruments accurate to within .75%, each assembled unit undergoes rigid tests in these categories. Strict quality control throughout manufacture assures you a transformer of maximum efficiency and working life. Actual impedance appears on nameplate to nearest tenth of one percent.

3 IMPULSE TEST. This *special* dielectric test, included as a further guarantee of Delta-Star Transformer quality, impresses a standard 1½ x 40 wave on each primary lead at the basic impulse level of the highest rated voltage. An oscilloscope monitors the test, retaining impulse images for critical observation and/or photographing.

4 INSULATION - POWER - FACTOR TEST. A Delta-Star exclusive. Once regarded only as a power-transformer test, this is given to each Delta-Star Distribution Transformer, regardless of rating, as an extra assurance of maximum operating life and freedom from the faults that might cause service interruption and early need for repairs.



5 APPLIED-POTENTIAL AND CORONA TEST. Here again, Delta-Star puts its distribution transformers through tests that no other manufacturer uses. The Corona Detector Test shown above employs the most sensitive equipment available to assure absence of rf interference at operating voltages. The applied-potential test is made at the same time.

6 INDUCED-POTENTIAL TEST. Another standard ASA dielectric test, in which a 400-cycle voltage is impressed across full windings. Started at zero, the voltage is brought to full value in less than fifteen seconds. After eighteen seconds, the voltage is returned to zero in less than five seconds.

EXCLUSIVE! EVERY DELTA-STAR TRANSFORMER passes all six of these tests . . . and more

These are regular production-line tests at Delta-Star —not merely spot checks—that help assure the consistent high quality of Delta-Star Distribution Transformers in every EEI-NEMA rating up to 167kva. These rigorous tests are only one important reason why you should investigate the merits of Delta-Star Transformers—to provide your community with maximum uninterrupted service during normal and extraordinary conditions.

FREE CATALOGS. Complete specifications are given in two new Delta-Star Distribution Transformer catalogs. For your copies, write *Delta-Star Electric Division, H. K. Porter Company, Inc., 17th & Cambria Streets, Philadelphia 32, Pa. District offices in principal cities.*

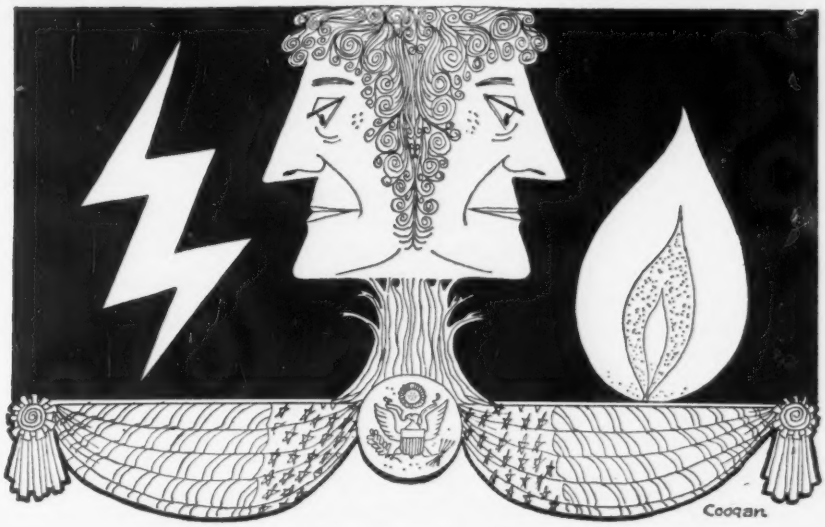
AND *EXTRA* TESTS FOR EXTRA QUALITY !

Testing of Delta-Star Transformers begins with materials. Destructive and operative tests are carried out regularly on insulations, oil, core steel, wire—every part of every unit. The superior quality of Delta-Star Transformers *rests* on *tests.*

H. K. PORTER COMPANY, INC.

DELTA-STAR ELECTRIC DIVISION

Connors Steel, Delta-Star Electric, Disston, Forge & Fittings, Leschen Wire Rope, Refractories, Riverside-Alloy Metal, Thermoid, Vulcan-Kidd Steel, H. K. Porter Company (Canada) Ltd.



Report on
All-Electric Service

It takes a hard look at electric vs. gas service to find . . .

What's Best for Military Housing?

A sound choice between all-electric and combination gas-electric service for a military multiple housing project can only be made after detailed economic analysis. A study just completed by the consulting firm of Gilbert Associates, Inc, sets forth a systematic procedure for making such an analysis. It also shows once and for all that there is a place for the all-electric home in military multiple housing projects located in many areas of the U. S. (see table below).

The Gilbert study was commissioned last March by Edison Electric Institute. Its 147 pages contain no "pat" answer to the question of which service is most economical, nor do they offer any simple formula for determining which is most

Here's a Comparison of Total Annual Costs

ENERGY SOURCES	100% Occupancy Thermal Insulation Medium	100% Occupancy Thermal Insulation Full	Annual Cost Reduction with Full Insulation	Less than 100% Occupancy 90% Occupancy	Less than 100% Occupancy 80% Occupancy
NORTH CENTRAL NORTH CAROLINA:					
All Electric Service:					
1 Heat Pump Heating	$186,809	$175,437	$11,372	$168,537	$161,645
2 Resistance Electric Heating plus Electric Air Conditioning	209,837	189,434	20,403	180,932	172,422
Minimum Electric Service:					
3 Gas Heating plus Elec. Cooling	228,558	210,216	18,342	201,681	193,138
4 Gas Heating and Cooling	268,385	237,236	31,149	226,869	216,505
NORTHERN GEORGIA:					
All Electric Service:					
1 Heat Pump Heating	192,857	180,296	12,561	172,907	165,536
2 Resistance Electric Heating plus Electric Air Conditioning	218,825	196,262	22,563	187,024	177,788
Minimum Electric Service:					
3 Gas Heating plus Elec. Cooling	189,952	179,852	10,100	173,935	168,028
4 Gas Heating and Cooling	200,887	187,182	13,705	181,311	175,183

Here's How Gilbert Associates

The Problem: Which is more economical for a specific military housing project—all electric service, or a combination of electric and gas services?

For their example Gilbert Associates took a 500-unit Capehart type project located in the 3,500 degree-day heating/1,000 cooling-hour zone which stretches coast to coast across the middle-southern U. S. The development was assumed to be adjacent to a military base with electric service provided by a primary circuit from the base substation to a point of connection with the housing area distribution system. Gas service, if any, would be delivered to the housing area distribution system through mains extended by the supplier from a principal supply line. All of the electric service would be supplied under one contract and at a single point of delivery for both the military base and the housing development. The same arrangements would apply to gas service. Both electric and gas distribution systems for the housing area would be installed and owned by the military.

The Costs to be Considered: In addition to the direct costs of energy supply (electric or combination electric and gas), it is necessary to compute the annual operation, maintenance, and capital costs of the distribution systems, heating and cooling equipment, other major appliances to be permanently installed, and structural variances in the houses, depending upon the service used.

Gilbert engineers laid out the "hypothetical but typical" housing development based on plans and specifications of a military housing project actually under construction in 1958. *They designed distribution systems, selected major appliances and heating and cooling equipment, and made such structural modifications as were appropriate for each of these four service plans:*

1. *All electric service with heat pump for heating and cooling*
2. *All electric service with resistance heating and central air conditioning*
3. *Minimum electric service; gas for major appliances and heating, with electric central air conditioning*
4. *Minimum electric service; gas for major appliances, heating and air conditioning.*

Annual operation, maintenance and capital costs were computed for each of the four service combinations.

Computation of Annual Energy and Related Costs: Evaluating energy supply costs cannot be accomplished "by reviewing a few electric and gas rate schedules", notes the summary of the Gilbert study. Here is their recommended procedure:

1. Establish, from load research and other available sources, the normal operating patterns of major electric and gas appliances and the operating patterns of each of the various combinations of appliances being considered for installation in the housing units. From these operating patterns, an accurate estimate may be made of the average daily, monthly and annual energy requirements and the average and maximum group demand characteristics of the various major appliance combinations.

Gilbert Associates used a wealth of electrical appliance load data from utility tests, public housing, and their own load research, to come up with average consumptions, load patterns and diversity characteristics for each electric appliance and combination of appliances. Superimposing the various load patterns, and considering diversity factors for a 500-*unit development, they found the pattern of demand and energy requirements for the electric appliances of the entire development. A typical mix of two, three and four-bedroom houses was considered in the calculation to set the level of consumption and demand. Also taken into account was the fact that energy use normally is higher when utility services are provided free of charge to the occupant.*

Gas appliance load patterns were developed from test data from counterpart electric appliances, adjusted for differences in heat conversion or efficiency

economical in all cases. What they do offer is a way to analyze each housing project on its own merits: the factors that must be considered and the calculations that must be made to find out whether all-electric or gas-electric service is best for a specific housing development in a specific location.

Gilbert Associates' method of comparing costs is outlined across the top of these two pages. The study emphasizes that reviewing a few gas and electric rate schedules is not enough; not only direct energy costs, but also the capital, operating, and maintenance costs of distribution facilities, appliances, heating and cooling units, and of the houses themselves must also be considered. To take

Compared Electric vs. Gas Service Costs . . .

ratios. From these calculations were developed the gas and electric load patterns for a development of 500 units with the several combinations of appliances being considered for use. A series of working charts and tables was devised to calculate the loadings and patterns of use of the various appliance combinations as related to number of housing units involved.

2. Calculate the load patterns for each of the heating and cooling devices under consideration in the specific housing development. These calculations must be based upon the heat loss or gain characteristics of the houses, the design temperature differences between desired indoor temperature and the extreme outdoor temperatures of the heating or cooling periods. Considering diversity, the heating and cooling load patterns are superimposed on the basic appliance load patterns to obtain the composite load patterns of the project.

Gilbert engineers also prepared a series of charts which relate hourly coincident demand to temperature for a project with 500-unit diversity. Working through these charts, and using actual temperatures from a U. S. weather station in the 3,500 degree-day zone, they established load curves defining the electric heating and cooling loads. The demands taken from these curves and the energy requirements of each of these heating and cooling devices were added to the appropriate basic use and major appliance loads.

3. Add the energy requirements and coincident demands of any other housing area loads, such as street lighting; and allow for gas and electric distribution losses.

Electric distribution losses in the example were calculated to fall between 4% and 6% for the various alternative systems. Gas system losses were calculated at 1½%.

4. Integrate the electric load pattern of the entire housing area with that of the military base itself, to establish the diversity between the two loads. The result is the composite load pattern of base and housing area together.

5. Calculate energy cost of the housing area and base combined, using the appropriate rate schedules. From this figure, subtract the energy bill of the base alone. The remainder is the incremental energy cost of serving the housing area.

In the example Gilbert Associates applied rate schedules applicable in two specific locations in North Carolina and Northern Georgia. The utilities involved in North Carolina were Duke Power Co and Piedmont Natural Gas Co. In Georgia, they were Georgia Power Co and Atlanta Gas Light Co.

6. Since a housing project will not always be completely occupied, it is also necessary to factor the extent of occupancy expected into the calculation of energy costs.

It is indicated that the average long-term occupancy of military personnel housing projects is about 80% or 90%. In the example, Gilbert calculated energy costs for 100%, 90% and 80% occupancy.

Computation of Total Annual Project Costs: Total project annual costs are established by adding electric energy costs, gas energy costs (if any) and incremental operation, maintenance and capital costs. These include structural modifications, variations in wiring and gas piping installations among various combinations of service, and reduction in cleaning and redecorating costs with full electric service, as well as costs of heating and cooling equipment, appliances, and distribution systems.

The total costs computed in the example are shown on the table at the foot of page 63. Although Gilbert Associates warns that only by a full analysis of each specific housing project can the most economical type of service be chosen, "the present study demonstrates that all energy requirements of multiple family military housing can be effectively and economically supplied by electric service in many areas of the United States."

---

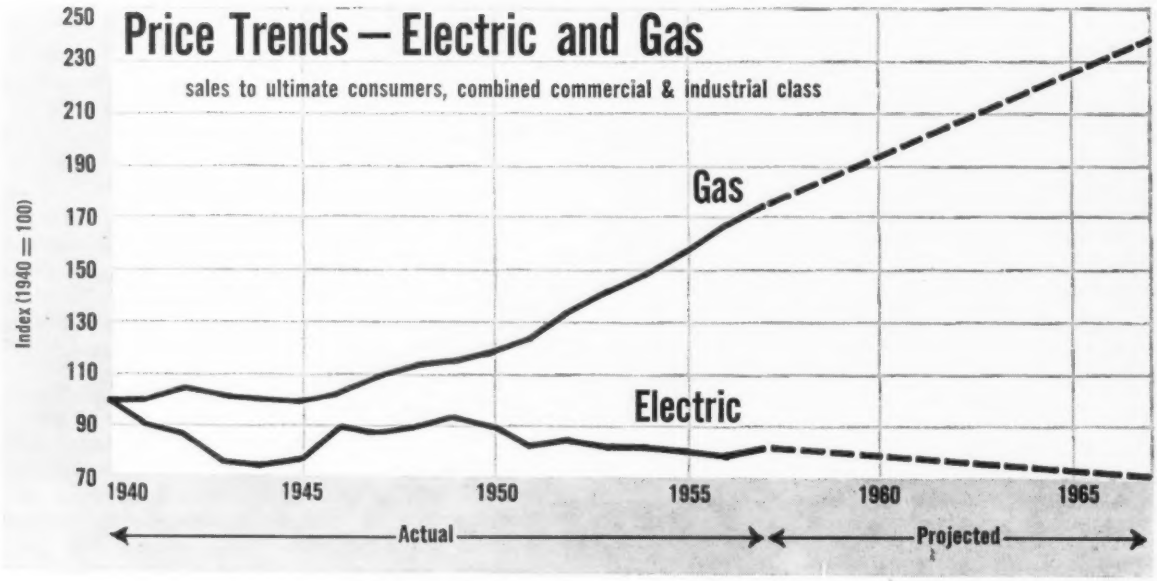
just one example: With all-electric service, no gas distributing facilities are needed at all. On the other hand, when gas is used to the maximum— for heating, cooling, and all possible appliances—an electric distribution system is still needed for lighting, for the many electric appliances which have no gas-powered counterparts, and for the motors and controls on the gas appliances themselves. This entails two sets of distribution facilities, which cost more than the single system needed for all-electric service.

Not considered in the study are the many intangibles favoring electric service. The report mentions "qualitative factors" such as safety, better humidity control

and less heat wastage with electric cooking equipment, ease of operation and cleaning of appliances, and the user's evaluation of the modernity of his service; but these cannot be assigned a dollar value, and they do not enter the calculations. The study notes, however: "When economic factors are closely balanced, the qualitative factors may well become the determining element. . ."

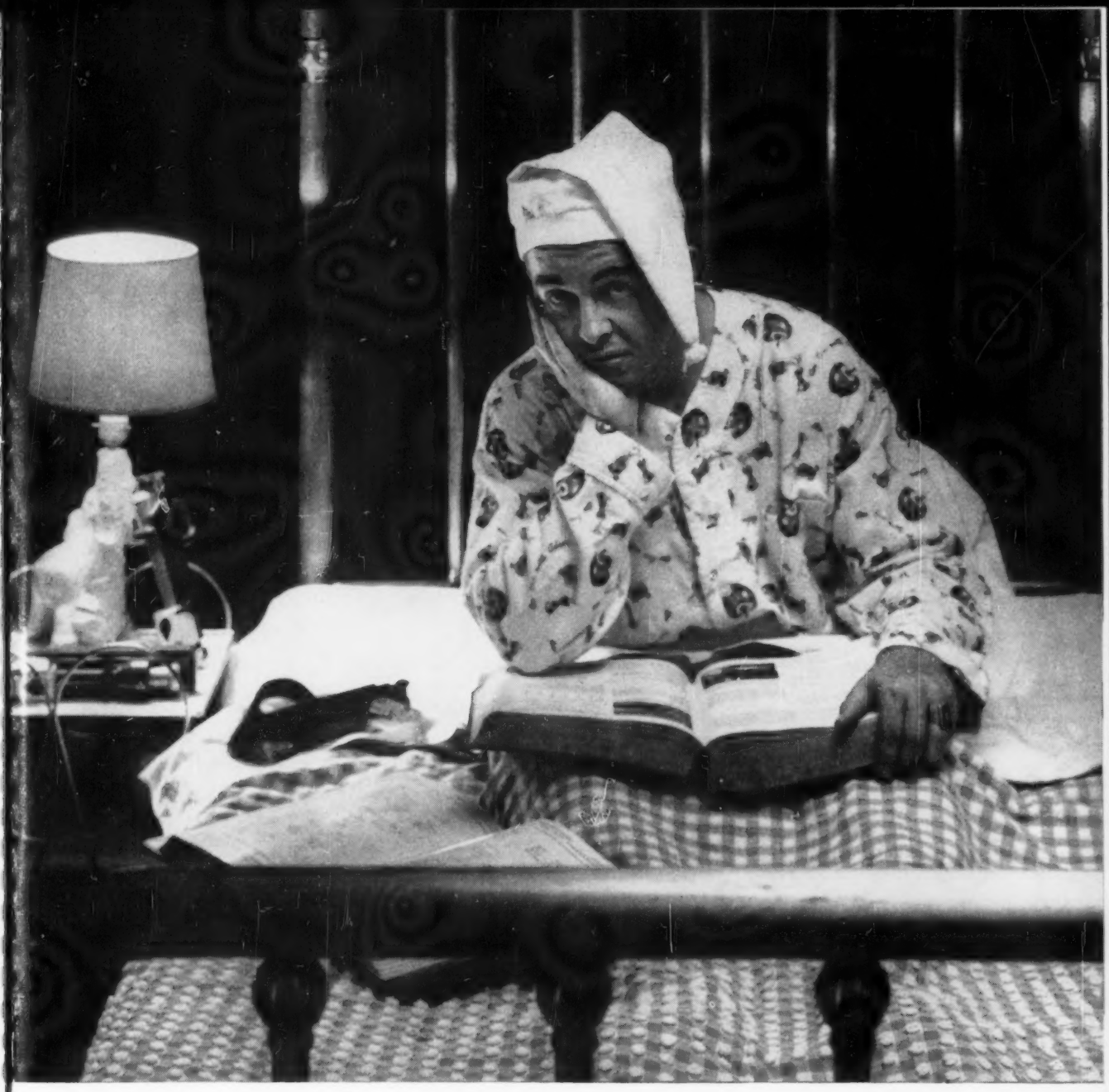
In addition to these "qualitative factors," there exist two significant economic factors that cannot be evaluated precisely. One is the long-term cost saving due to reduced hazard of fire or explosion with electric service. The other is the clear indication that costs of gas service will increase faster than costs of electric service.

In the Gilbert study, energy costs were computed at present price levels—future prices were not considered in the calculations. The chart below shows the relative price trends of gas and electricity to commercial and industrial customers: Since 1940 the price of gas per therm has risen by about 73%, while the price per kwhr of electricity has actually declined by about 20%. If the trend of the past 17 years should continue, by 1967 the relative cost position of electric service would have improved 56.5% over gas. The dotted lines on the chart are not predictions, but simple projections of past trends. They do indicate, however, that the future is likely to see all-electric service become relatively more economical than it is today.



EEI plans to spread word about this study throughout the country. William M. Shepherd, vice president of Arkansas Power & Light Co and chairman of EEI's Electric Housing Subcommittee, said: "There has long been a need for a compilation of factual basic data on the characteristics of applications of the various energy sources to housing needs. This report, based upon thousands of actual load studies, is the first effort to provide engineers, architects, and builders with this essential data."

Wide interest in the Gilbert report can be expected. Although the study confines itself to military housing, it is clear that with a few modifications the same treatment could apply to private housing developments.



Shopping for hardware . . . or protection?

Lots of utility men have come to accept the old reliable fuse cutout as so commonplace that it can be bought from a catalog like a piece of hardware . . . considering all makes equal in performance.

You'd never dream of short-changing yourself when it comes to protecting your generators or large transformers. Why not the same regard for *distribution* protection?

It will pay you to investigate the real difference in fuse cutout values. Development testing at Westinghouse's High Power Laboratory guarantees that extra value in Westinghouse fuse cutouts. J-60949-1

See how Westinghouse makes "protection buying" A Sure Thing (*turn page*)

HERE'S A MODERN "TORTURE RACK"

A truly universal cutout...type EU

Exhaustive testing at the Westinghouse laboratories proves the ability of their new universal EU cutouts. The stop-motion photos above show one stage of testing the EU cutout . . . satisfactorily interrupting an 8000-amp fault. Controlled current interruptions with maximum asymmetry insure capacity to handle over and over the most severe faults which will occur on your system.

But interrupting tests are not enough. Before a new design is ready for sale, temperature rise, radio influence, impulse tests, wet and dry withstand tests, vibration and shock tests must be completed. They are your assurance that you are getting the best protection your dollar can buy.

Ask your Westinghouse sales engineer today for complete test specifications and a demonstration of this cutout in your own office . . . or, for complete information, write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa.

WESTINGHOUSE HIGH POWER LAB

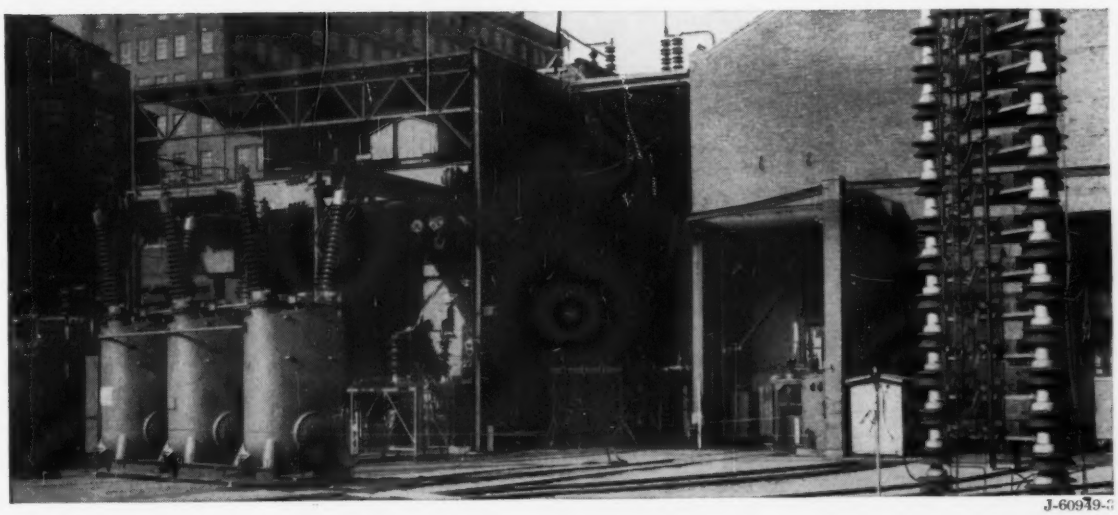
Anyone with a transformer, a circuit breaker and a cutout can carry out interrupting tests, but it's a different story for *fundamental* research! Investigation of tube rocket action, erosion and current clearing ability is a time-consuming process requiring years of engineering experience and extensive test facilities found at the Westinghouse High Power Lab.

J-60949-2

YOU CAN BE SURE...IF IT'S **Westinghouse**

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV MONDAYS

THAT DEVELOPS BETTER CUTOUTS



J-60979-3

National Landscaping Award Won by Connecticut L&P Co

The substation at left has been judged "the most beautifully landscaped" facility of its kind in the U. S. Located on route 57 in the Norwalk area, the Weston substation of Connecticut Light & Power Co gained the "Plant America" award in the sixth annual industrial and institutional landscaping and beautification competition conducted by the American Association of Nurserymen. The power company was the only utility award winner in the substation category among entries from Canada, Hawaii and the U. S.

CL&P Arborist Herbert J. Cran, Jr, won an individual award for designing the substation's landscaping and was commended for professional competence. W. W. Forman, company vice president, accepted the plaque award for the station.

The company noted that, with increasing electricity use, power companies' improvement of residential substation appearances has been a big factor in the trend by U. S. industry to spend more money and effort on trees, flowers and plants that beautify its premises.

Single Shell Contains Heaters (*Continued from page* 47)

offset by the fact that the boiler feed pump, supplied with a higher suction than usual, operates with a lower pressure differential and, therefore, consumes less power, even when operating at a higher temperature.

In the 150-Mw unit, feedwater enters the boiler feed pump at 498F and would flash at about 670 psia. A suction head requirement of 750 psia will prevent the pump's cavitation. If total friction and static losses equal 200 psi, the condensate pump booster stage must produce 950 psia discharge outlet pressure. On the other hand, the boiler feed pump needs only to raise the pressure from 750 psia to boiler pressure plus friction losses, amounting to about 1,720 psi increment. Compared to a conventional boiler feed pump, receiving liquid at 300F and 90 psia, power savings obtained with the "K" Heater can be estimated at about 20%.

It is not advisable to bypass any portion of the steam or water circuits within the "K" Heater, as this cycle's main virtue lies in its simplicity. When such partial operation is required, Kuljian recommends the use of two separate "K" Heaters, each sized for half or two-thirds capacity and mounted symmetrically on either side of the turbine.

It is possible to operate the "K" Heater with or without a drip pump. When a drip pump is used, the lowest pressure compartment of the "K" Heater requires no drain cooling zone. Drained condensate may be pumped into the feedwater line either before or after the low pressure stage and thus returned directly to the "K" Heater. This procedure reduces the volume of condensate handled by the condensate pump. The drip pump must then discharge at a pressure equal to the condensate pump's booster stage.

Without the drip pump, the condensate is sub-cooled in the lowest pressure compartment and rejected to the condenser. The saving in cost of the drip pump may be somewhat offset by the larger volume demanded of the condensate pump. Also, due to the heat of drains rejected to the condenser, the heat rate increases about 4 or 5 Btu per kwhr. Any decision to omit the drip pump should be based on an economic study of the actual conditions.

First Leg of 400-Kv Grid Finished by Czechs

The first 60 mi of a planned 400-kv grid have been constructed in Czechoslovakia. The initial line links Sucany to Liskovec. According to Rude Pravo, a Prague daily, the project makes Czechoslovakia the seventh country in Europe with a 400-kv line in operation. It will be, too, the first of the East European (Soviet satellite) countries to achieve the higher voltage.

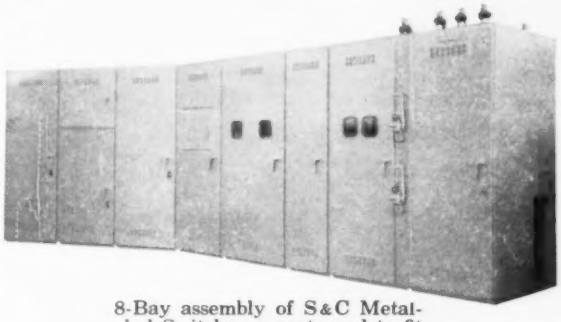
The h-v line will span the country in a west-east direction. About 44% of the energy will originate from western parts of Czechoslovakia.

Meanwhile the Soviets have under way 400-kv lines in her Ukranian GES, a regional power system. A short tie line could integrate the systems, possibly aiding the Czechs at a time of mounting difficulties in meeting local power requirements.

The U.S.S.R. plans to have a grid system linking all her European area in operation by 1962. It will have a capacity ranging from 2,000 to 3,000 Mw. Grids in Central Asia, Central Siberia, Kasakstan and Transcaucasia are to be linked later.

The Port of Portland's extreme reliability requirements are met by S&C's Fused Interrupter Metalclad Switchgear with S&C Automatic Transfer Panel and Moto-Draulic Operators

Nation's newest jet-age terminal gets modern S&C Metalclad Switchgear



8-Bay assembly of S&C Metalclad Switchgear contoured to fit location at Portland International Airport.

Consultant on high-voltage electrical equipment: George A. Drewett, area engineer for Pacific Power & Light Co.

Extreme reliability of electrical services is a major requirement of the modern jet-age airport, because of the great number of vital radar and lighting needs.

Pacific Power & Light's staff studies showed that this high degree of reliability suggested the use of fused interrupters metal-enclosed, with an integral automatic transfer panel controlling operators for preferred-to-emergency switching.

Result: Modern S&C Metalclad Switchgear was specified.

The power circuits of this modern new airport are run in conduits or protected cable trays, and so are free from transient faults. The proper protection against the only type of fault which is likely to occur—a permanent fault—is the Power Fuse as employed in S&C Switchgear.

To maintain continuity of service, the installation uses S&C Load Interrupters actuated by a Moto-Draulic Operator which is controlled in turn by an S&C Automatic Transfer Panel. This modern equipment meets new, modern standards of reliability, and at the same time saves as much as 50% in capital outlay for switchgear.

For information, write S&C Electric Company, 4421 Ravenswood Ave., Chicago 40, Ill. In Canada: S&C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ontario.

Specialists in High-Voltage Circuit Interruption for Utilities Since 1910

S&C

METALCLAD SWITCHGEAR

McMEEKIN

RADER

WILLIAMS

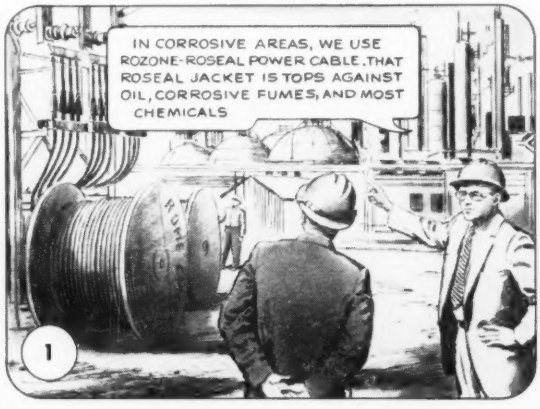
MUSTARD

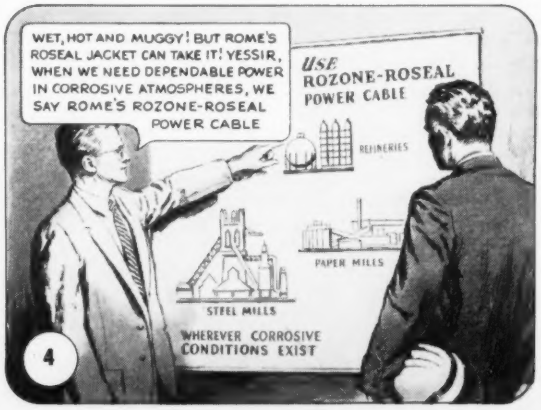
Key Promotions Made at South Carolina E&G

South Carolina Electric & Gas Co has made several changes and promotions among its executives.

F. R. McMeekin, vice president in charge of operations, was named to the board of directors and made a member of its executive committee. J. Frank Rader was elected vice president and chief engineer. Arthur M. Williams was elected vice president and staff counsel. A. C. Mustard was elected vice president in charge of commercial operations, and Harold M. Bryant was named assistant secretary. W. H. Kendrick, vice president in charge of commercial operations and industrial relations, has resigned.

McMeekin joined a predecessor company of SCE&G in 1925. He rose to chief electric dispatcher and then superintendent of transmission. In 1944, he was elevated to electrical engineer and later superintendent of power. When the company merged with SCE&G he was named manager of production and


IN CORROSIVE AREAS, WE USE ROZONE-ROSEAL POWER CABLE. THAT ROSEAL JACKET IS TOPS AGAINST OIL, CORROSIVE FUMES, AND MOST CHEMICALS
1


WET, HOT AND MUGGY! BUT ROME'S ROSEAL JACKET CAN TAKE IT! YESSIR, WHEN WE NEED DEPENDABLE POWER IN CORROSIVE ATMOSPHERES, WE SAY ROME'S ROZONE-ROSEAL POWER CABLE
USE ROZONE-ROSEAL POWER CABLE
REFINERIES
PAPER MILLS
STEEL MILLS
WHEREVER CORROSIVE CONDITIONS EXIST
4

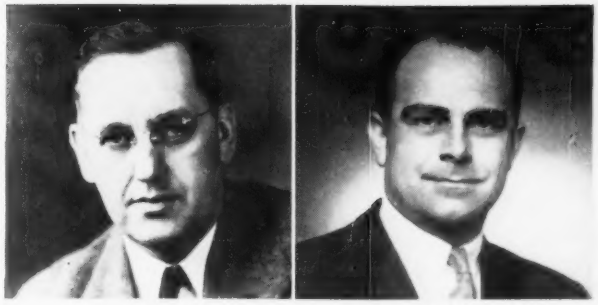
transmission. In 1951, he became operating manager, and then vice president in charge of operations.

Rader started his career with Metropolitan Edison Co. He was later sent to Central Vermont Hydro Corp and to Binghamton Light, Heat and Power Co. Next, he was sent to the Broad River Power Co, Columbia, S. C., and was subsequently promoted to general superintendent and then to chief engineer.

Mustard joined South Carolina Power Co. in 1935 and filled a number of positions in the engineering department. He rose to the position of district manager and in 1954 was named general commercial manager, electrical operations.

Bryant went with SCE&G in 1945. In 1946, he transferred to the personnel department and was named personnel representative in 1948. He was made personnel director in 1953.

Williams joined SCE&G in 1944 as personnel director and became staff counsel in 1948. Kendrick had been an executive of South Carolina Electric & Gas and its predecessor companies for more than 40 years.



SMITH STRICKLAND

Smith, Strickland Made VPs at GE

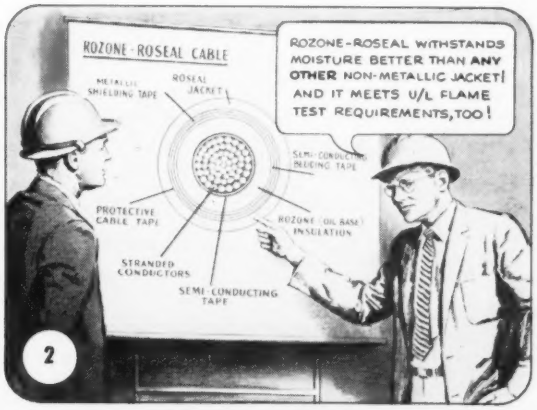
Raymond W. Smith and Harold A. Strickland, Jr, have been elected vice presidents of the General Electric Co.

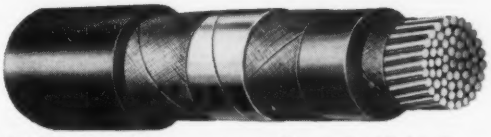
Smith is general manager of the company's Transformer Division; Strickland is general manager of the Industrial Electronics Division.

General manager of the Transformer Division since Jan. 1957, Smith joined GE as an accountant in Schenectady in 1928. Two years later, he was named auditor and assigned to the Allegheny Steel Co in Brackenridge, Pa. In 1933 he returned to Schenectady, and then went to Philadelphia as works accountant. He next held the same position in Pittsfield, Mass.

Later appointments were as manager-finance of the Transformer and Allied Products Dept and general manager of the Distribution Trans-

(*Continued on page* 74)





Available in voltage ranges through 15 kv Rozone-Roseal preferred power cable may be installed in air, conduit, underground ducts, or directly in earth. Your choice of premium ozone-resistant insulations: Rozone (oil-base) or Rozone A (butyl-base). For complete information, contact your nearest Rome Cable representative and ask for Bulletin RCD-700. Or mail the coupon today.

ROME CABLE
CORPORATION

A matter of FACT

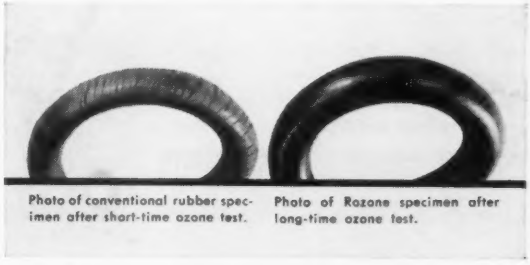


Photo of conventional rubber specimen after short-time ozone test. Photo of Rozone specimen after long-time ozone test.

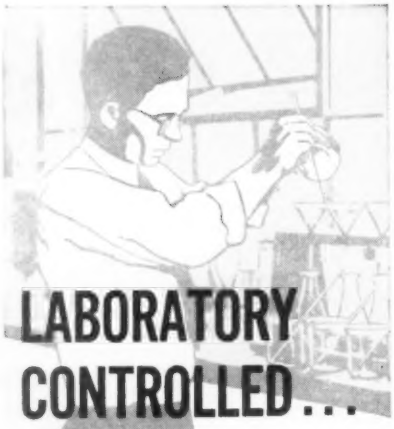
Rozone insulation is high in dielectric and impulse strength and has excellent resistance to corona and ozone cutting.

FREE BULLETIN describes the benefits of Rome's preferred high-voltage power cables.

ROME CABLE CORPORATION
Department 719, Rome, New York

Please send me a copy of the new Rome Cable Bulletin RCD-700.

Name .....
Title .....
Company .....
Address .....
.....
Type of business .....



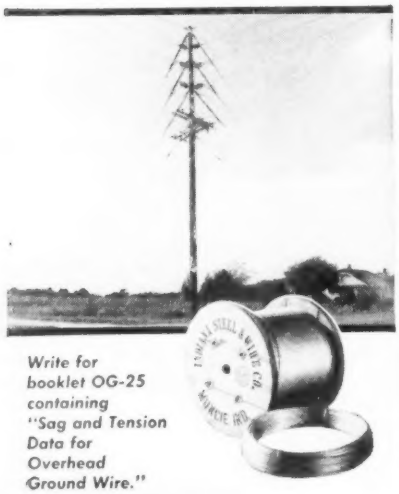
LABORATORY CONTROLLED...

Crapo

GALVANIZED STEEL STRAND FOR GUY, MESSENGER and OVERHEAD GROUND WIRE

The high, uniform, consistently-dependable quality of Crapo Galvanized Steel Strand is the direct result of close laboratory control over each step in manufacture. All wires used in forming a particular size and grade are produced from steel of selected analysis, carefully processed under technical supervision and stranded on precision machines. Both wire and finished strand are subjected to prescribed laboratory tests to insure the desired end result.

Heavy, uniform, tightly-bonded zinc coatings, applied by the famous Crapo Galvanizing Process, provide maximum resistance to corrosion.



Write for booklet OG-25 containing "Sag and Tension Data for Overhead Ground Wire."

INDIANA

STEEL & WIRE CO., INC., Muncie, Indiana

GE Names VPs

(*Continued from page 73*)

former Department.

Strickland has been general manager of the Industrial Electronics Division since June, 1956. He joined GE in 1950 as an executive engineer with the Hotpoint Division. In 1952, he was elected a vice president and appointed manager of engineering for the division. In 1955, he was appointed consultant-energy utilization in the Engineering Services Division.

Square D Names Kartalia VP

Square D Co has elected Mitchell P. Kartalia, manager of the marketing division, a vice president. Kartalia is responsible for all programs within the marketing concept, including distributor relations, field office operations, national advertising, market research, product development liaison, and export.

In his present post since July, he was formerly sales manager of Square D's distribution equipment division. He joined the company in 1940 as a sales application engineer and rose to various executive positions.

Rea Joins Duke Power Co

David Rea, former southeastern editor of Electrical World, has been named supervisor of promotional advertising for Duke Power Co.

Rea joined Electrical World in 1952 as assistant editor. He then served as northeastern editor and was appointed southeastern editor in 1955.

Previous to that he was with the U. S. Signal Corps developing and testing engine generators and their control systems, and worked as a distribution engineer for Seattle (Wash.) City Light. He is a graduate of the University of Washington in 1948 with a degree in electrical engineering.

PERSONAL BRIEFS

Duke Power Co has made the following additional appointments: **R. L. Henson,** assistant general superintendent; **J. S. Major,** superintendent of electrical maintenance and construction; **C. W. Cox,** assistant superintendent of electrical maintenance; **W. T. Reeder,** assistant superintendent of electrical construction-stations; and **H. K. Burris,**

assistant superintendent of electrical construction-plants.

Sacramento Municipal Utility District has appointed **Marlen N. Davis,** manager, sales development dept.

A. Percival Fugill, chief electrical engineer, electrical engineering division, planning and project engineering department, Detroit Edison Co, has been given a Certificate of Recognition by the Michigan Section, AIEE.

Don G. Mitchell, chairman of the board of Sylvania Electric Products, Inc., has been named chairman of the Commerce and Industry Committee for the New York Red Cross Chapter's 1959 campaign.

Bennett Associates, Inc. has appointed **D. W. Rice** manager of conduit and tubular materials. He was formerly product sales manager of the conduit division of National Electric Products Corp.

The following changes have been made at Radio Corporation of America: **Harold M. Emlein** has been named operations manager of the new industrial and automation division; **David A. Thomas** has been elected vice president and general manager, industrial and automation division; and **Charles H. Colledge** and **John J. Graham** have been appointed general managers for industrial electronic products.

Bailey Meter Co has appointed **G. E. Brien** resident engineer in the New Haven, Conn., subdivision of the New York district.

Charles Wenner has been named president of James R. Kearney of Canada Ltd. **Lincoln Wanger** has been named executive vice president and a member of the board of directors.

Harvey O. Banks has been reappointed director of the California department of water resources.

The Square D Co has appointed **Francis P. Daleiden** traffic manager of the industrial controller division.

Allis-Chalmers Manufacturing Co has appointed **D. A. Wooley** as manager of its London office.

STATIC

Sel-Rex®

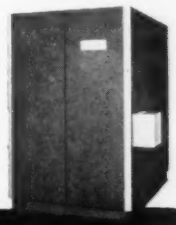
CUSTOM ENGINEERED

RECTIFICATION

Nothing to wear or get out of order in Sel-Rex Semiconductor Rectifier Equipment. Our rectifier equipment may be static in operation, but our engineering research and development is anything but! Sel-Rex is responsible for many rectification-engineering "firsts"—now taken for granted. Ask us about them and our current "firsts."

Send for FREE "GUIDE" to Industrial Rectifier Equipment.

- *Germanium*
- *Silicon*
- *Selenium*



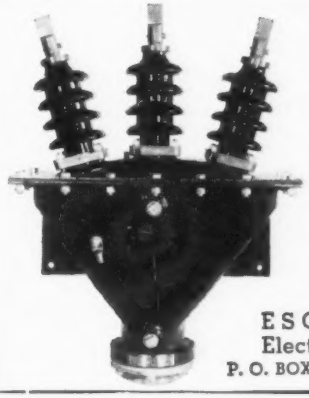
Rectifier Division

SEL-REX CORPORATION

NUTLEY 10, NEW JERSEY

Representatives in Principal Cities

"Complete Semiconductor Power Conversion Systems for any AC to DC application."



ESCO

DRAWN STEEL POTHEADS

In All Standard Body Shapes—and Sizes to 15000 Volts.

Detachable Porcelain Potheads at Cemented Porcelain Prices.

Write for Prices—and Delivery. Both are better than most.

ESCO MANUFACTURING COMPANY
Electrical Power Distribution Apparatus
P. O. BOX 1039, GREENVILLE, TEX. Ph. GL 5-6234

aren't you really above routing slips?

In all fairness to yourself and your job responsibilities, don't you deserve your own personal copy of Electrical World? Your name, title and residence address on your letterhead will bring you 52 issues of Electrical World. Make a better impression, more job headway. The cost—only $6. No need to send money now.

Electrical World
330 West 42nd Street, New York 36, N.Y.

yep...enter my subscription

to 52 issues of Electrical World—delivered each week to my home. You can bill me later for $6...

Name_____
Address_____ House ☐ Business ☐
City_____ Zone____ State____
Title_____
Firm_____

Electrical World
330 West 42nd Street, New York 36, N.Y.

H-3

Single-Phase Serves Better (*Continued from page* 39)

units, permitting zone temperature control.

4. Improved insulating permits smaller units.

These factors indicate that the large volume of central units will be 5 tons or less. In establishing the average cost it was assumed that three 3-ton units will be installed for each 5-ton unit.

Transformer cost estimates were based on the most economical 3-phase installations and an existing single-phase load density of 25 to 50 kva per 1,000 ft.

An open wye-open delta transformer connection is used with a lighting transformer on one pole and the power transformer on an adjacent one. This provides the most economical arrangement and sometimes eliminates the need for 3-phase secondary circuits. Combination light and power service is at minimum cost.

More Primaries Added

At 10% saturation of central air conditioners, it is assumed that 3-phase primary will be available in 88% of the system for phase balancing and voltage regulation. Therefore, in computing the cost for 3-phase only 12% more primary conductors are added to the distribution system. The primary system accounted for only 3% of the total additional cost.

Secondary design is based on No. 1/0 bare aluminum conductors with banking fuses between adjacent single-phase transformers. By installing the power transformer a span away from the lighting transformer, some 3-phase air conditioning units may be served directly from the power transformer.

A 15-amp meter is used for both the single and 3-phase services. The cost differential is held to the minimum by using a two-element polyphase meter. Service drop costs are based on 100 ft of multiplexed No. 4 aluminum supported by an ACSR neutral.

The 3-phase air conditioning units will increase the kilovar demand, as 3-phase units run at a lower power factor. To bring the power factor load up to that of the single phase load, a 1.5-kvar capacitor would be required for each 3-ton unit and a 2-kvar capacitor for each 5-ton unit. Secondary capacitors were used. Their average cost is $28 per air conditioning unit.

Operation and maintenance of 3-phase distribution facilities cost more than single-phase. There are about twice as many distribution transformers, fuse cutouts, and lightning arresters on a 3-phase system. The 3-phase meters are more expensive to maintain. There are more secondary and service conductors. The differences in operating and maintenance cost per air conditioning unit at 10% saturation, based on an analysis of OG&E records, are shown in Table I.

Service Quality Better

Quality of service for single-phase equipment is considerably better. The improved continuity of single-phase service is inherent in the design of the distribution system. Operation of a sectionalizing fuse on a 3-phase wye primary circuit disrupts service to all 3-phase customers served by a wye-delta, or delta-delta transformer bank and to two-thirds of the 3-phase customers served by an open-wye or open delta transformer bank. The operation of the fuse disrupts service to only one-third of the single-phase customers.

Voltage balance is a problem in serving 3-phase motors on residential systems. Two single-phase customers, one receiving 245 v and the other 230 v, will probably consider their service satisfactory. But a 3-phase customer receiving 230 v on one phase and 245 v on the other will have unsatisfactory service.

Voltage flicker caused by starting single-phase motors of modern design is now less than that for 3-phase motors on 120/240-v, four-wire delta, combination light-and-power circuits, transformer kva, conductor poundage, and length of feed being all equal. Flicker is on the 120-v basis which affects lights and television sets, not on 240-v basis divided by two. A 3-phase motor requires about 50% more starting kva than a single-phase, capacitor-type motor of equal size. When service is single-phase, the transformer serving all lighting and motor loads is large. The larger transformers with single-phase utilization have greater motor starting and running capability. The reduced flicker results in fewer complaints.

Ultimately the customer benefits from the reduction in cost of electric service and improvement of air conditioning equipment. To obtain reliable information on the total actual cost of the installed unit, including house wiring and annual maintenance and service, surveys were made of sales and service representatives of leading manufacturers and house-wiring contractors in the service area of the OG&E. The maintenance and service expenses were based on experience of local sales and service personnel through 1956.

Prices Converging

Results of this survey are in Tables II, III and IV and Fig. 2. The difference between the sale price of a single-phase and a 3-phase unit has decreased to $23 (1.8%) for 3-ton and $44 (2.7%) for 5-ton units. This difference has been decreasing over the last seven years. The reduced cost of the single-phase unit was made possible largely by application and improved design of capacitor-start capacitor-run single-phase motors.

The electrical characteristics of hermetically sealed motor compressor units are substantially improved. Data published by NEMA and others for general purpose motors do not apply to these motors which are cooled by a refrigerant. Average electrical characteristics of 1957 models of central air conditioning units are shown in Table IV. The high starting and running power factors of the single-phase units are noteworthy. One result is that the starting current for the single-phase units is only slightly greater.

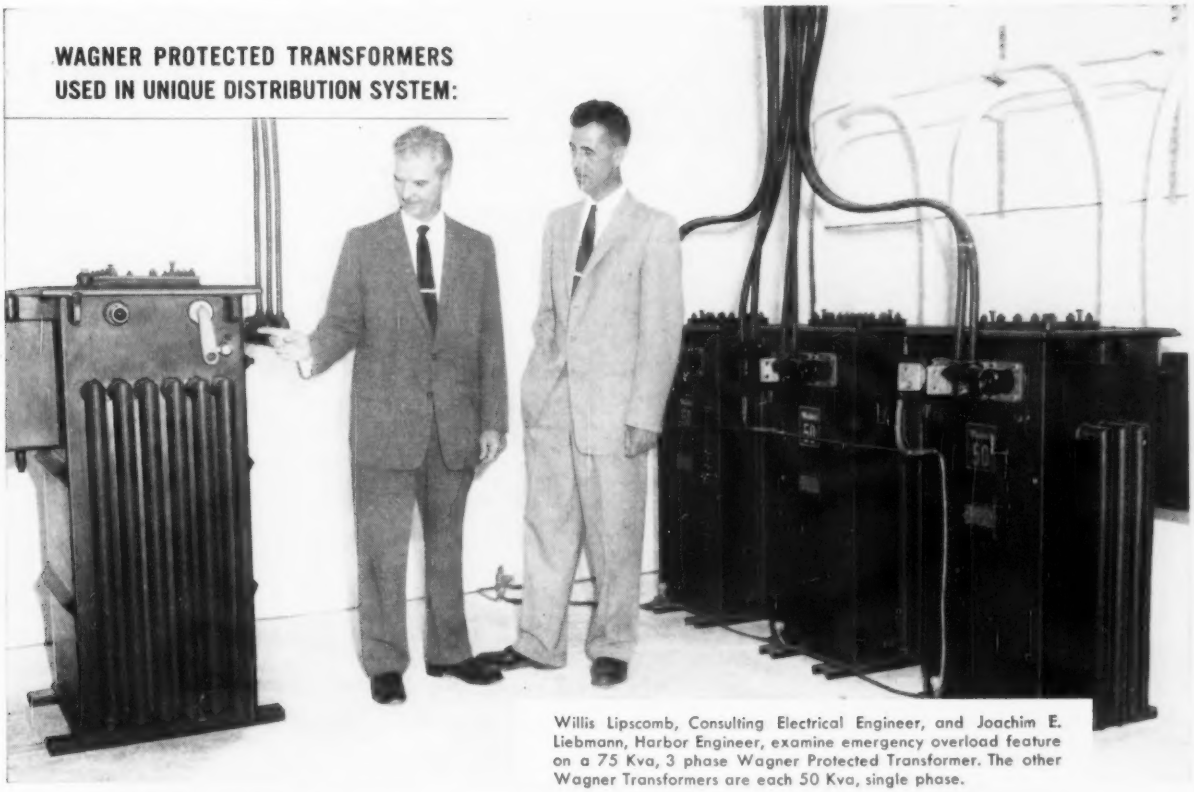
The efficiency of the single-phase motor is about equal to that of a 3-phase motor, assuming perfectly balanced 3-phase voltages. Under normal operating conditions, 3-phase voltage unbalance is always present to a degree. If the voltages are significantly unbalanced, reduced efficiency and excessive heating result.

Excessive heating is particularly undesirable for hermetically sealed units where the motor must do additional work to pump out its own losses. Any reduction in compressor motor efficiency is reflected in bills.

Cases of 3-phase motor failures were reported. These failures may be due to overloading or to normal temporary voltage unbalance. No case of single-phase motor failures were reported. Single-phase units are

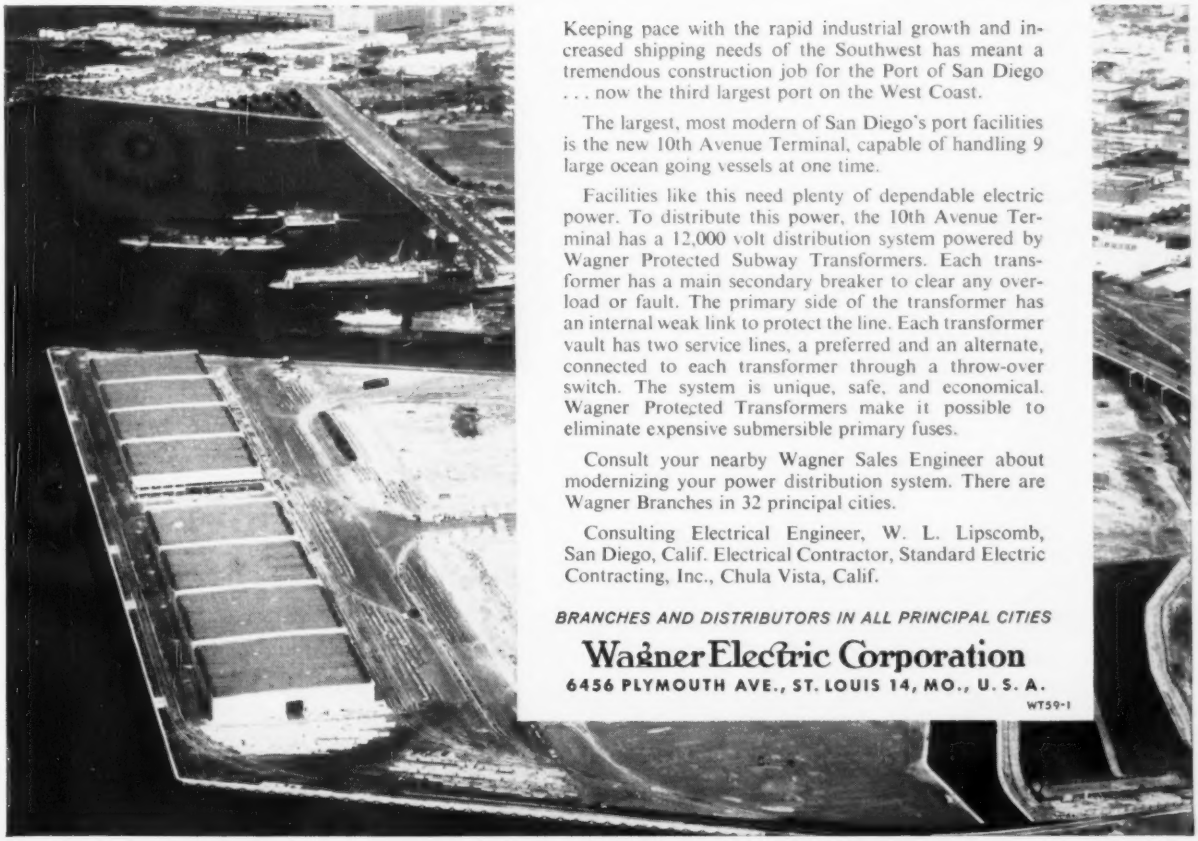
(*Continued on page* 80)

WAGNER PROTECTED TRANSFORMERS USED IN UNIQUE DISTRIBUTION SYSTEM:



Willis Lipscomb, Consulting Electrical Engineer, and Joachim E. Liebmann, Harbor Engineer, examine emergency overload feature on a 75 Kva, 3 phase Wagner Protected Transformer. The other Wagner Transformers are each 50 Kva, single phase.

POWER for the Port of San Diego



Keeping pace with the rapid industrial growth and increased shipping needs of the Southwest has meant a tremendous construction job for the Port of San Diego . . . now the third largest port on the West Coast.

The largest, most modern of San Diego's port facilities is the new 10th Avenue Terminal, capable of handling 9 large ocean going vessels at one time.

Facilities like this need plenty of dependable electric power. To distribute this power, the 10th Avenue Terminal has a 12,000 volt distribution system powered by Wagner Protected Subway Transformers. Each transformer has a main secondary breaker to clear any overload or fault. The primary side of the transformer has an internal weak link to protect the line. Each transformer vault has two service lines, a preferred and an alternate, connected to each transformer through a throw-over switch. The system is unique, safe, and economical. Wagner Protected Transformers make it possible to eliminate expensive submersible primary fuses.

Consult your nearby Wagner Sales Engineer about modernizing your power distribution system. There are Wagner Branches in 32 principal cities.

Consulting Electrical Engineer, W. L. Lipscomb, San Diego, Calif. Electrical Contractor, Standard Electric Contracting, Inc., Chula Vista, Calif.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

Wagner Electric Corporation

6456 PLYMOUTH AVE., ST. LOUIS 14, MO., U. S. A.

WT59-1

Industry Moves Ahead with Plan '59...

To modernize now for growth and profits

The most expensive task to be performed in America, in this new year of 1959, is the modernization of our industrial plant and equipment. This is true despite the huge expenditures on new facilities made in the past decade.

Contrary to popular opinion, and even to much learned opinion, our industrial facilities are not up to date. In a special survey conducted in August 1958, and supplemented by further interviews since that time, the McGraw-Hill Department of Economics found that it would take $95 billion to bring all our plant and equipment up to the best modern standards. This is over $15 billion more than the record budget of the U.S. government for the coming year.

How did we get so far behind? It is true that business has made record capital expenditures in recent years, but most of this investment has been to expand capacity. And in concentrating on new capacity, industry has fallen behind on the modernization of older facilities. Meanwhile, the $8 billion a year surge of research and development has brought forth new machines and new processes, at a rate that makes prewar and even early postwar equipment badly obsolete.

The lag between what research has promised —especially in more efficient tools of production —and what has actually been accomplished up to now shows clearly in the AMERICAN MACHINIST inventory of metalworking equipment for 1958. This new study, covering 167 types of equipment in 5,800 metalworking plants, shows that three out of five metalworking machines are over ten years old. This is a startling indication of how obsolete many plants have become. A 1958 machine tool is 54% more productive than one purchased in 1948. Many of the tools industry now uses are actually of 1939, or earlier, design.

Investment Starts Up

Now industry's plans for 1959 show a new awareness of the need to modernize. In its surveys, conducted during the last part of 1958, the McGraw-Hill Department of Economics discovered these facts:

(1) Companies generally believe that a larger investment in modernization will

mean more profits—soon. Most of the manufacturing companies in the surveys expect their current modernization expenditures to pay off in less than five years. With labor costs rising steadily, it is only with better, more modern equipment that most companies can hope to make these profit gains.

(2) Industry's plans for modernization have been revised upward. Total plans for 1959 investment, in new plant and equipment, now come to $33 billion—compared with $31 billion reported earlier. And most of these new plans are directed toward modernization—installing new processes or making ready for new products, developed out of the most recent scientific advances.

It therefore seems clear that modernization expenditures in 1959 will rise enough to make an impressive start on the job of updating our plant and equipment. But it will be no more than a start. Research also is moving ahead with giant strides. Plant expenditures must increase rapidly, from 1958's low level, to win the battle against obsolescence.

How Can We Modernize Faster?

What can we do to accelerate industry's new drive for more modern plant and equipment? One aid will be an improved flow of technical information on how, and where, to modernize. With this purpose, the McGraw-Hill Publishing Company several months ago inaugurated PLAN '59, a joint effort by all its magazines to spotlight the best opportunities for modernization. During 1959, McGraw-Hill publications will continue this effort by putting special emphasis on new developments in plant and equipment.

On the key problem of financing modernization—the question "Where's the money coming from?"—the McGraw-Hill Department of Economics plans several new studies in the months ahead. The first of these will deal with the number one problem in financing: the need for adequate depreciation allowances. Such studies are a small, but we hope a helpful, part of the total effort that is needed to modernize American industry.

An Individual Effort

The really vital steps in modernizing must be taken by individual companies. The backlog of obsolete plant and equipment is widely dispersed, among firms of all sizes and in all areas. It cannot be wiped out by dynamic equipment policies on the part of a few leading firms. Not just a few, but thousands of industrial companies must take inventory of their respective equipment and compare it, case by case, with the best new machines available.

Finally, there is need for increased public recognition of the modernization problem, and for federal tax policies appropriate to a period of rapid technical change in business.

The most important point is that the modernization drive has begun. This start can accelerate, with intelligent business and public policies, to give us truly modern industrial facilities. Plant and equipment expenditures are finally beginning to reflect the stepped-up pace of research and development. This can be a major factor in renewed economic growth and prosperity as we move into 1959.

This message was prepared by the McGraw-Hill Department of Economics as part of our company-wide effort to report on opportunities for modernization in industry. Permission is freely extended to newspapers, groups or individuals to quote or reprint all or part of the text.

Donald C. McGraw
PRESIDENT
McGRAW-HILL PUBLISHING COMPANY, INC.

Single-Phase Serves Better

(*Continued from page 76*)

not susceptible to phase-unbalance troubles.

The survey of sales and service companies revealed that the average annual additional maintenance and service costs for single-phase were $474 for 100 3-ton units and $683 for 100 5-ton units compared to the costs for a like number of 3-phase units. These additional maintenance costs reportedly were caused by failure of the starting capacitors and their inaccessible locations. Improved designs and locations have been made; and the additional maintenance cost of single-phase units may be expected to disappear.

Most manufacturers guarantee all components of the refrigeration cycle for five years regardless of whether the motor is single or 3-phase. All other parts are guaranteed for one year.

As a result of the surveys and studies it has been concluded that:

1. Refrigerated cooling can be delivered through a single-phase central unit in the customer's residence for 13 to 15% less total capital investment by the customer and the utility. The saving in capital investment for utility plant will accrue to the benefit of the customer also.

2. The customer's installation cost, including house wiring, for central air conditioning is practically the same for single and 3-phase.

3. The average saving in utility investment with single-phase utilization is approximately $236 per air conditioning unit with 10% saturation.

4. The additional investment for 3-phase utilization will ultimately result in higher rates to residential customers than if single-phase residential utilization is adopted universally.

5. Utilities should review rules pertaining to residential service, recognizing the improved characteristics of the new air conditioning equipment.

6. Most residential central air conditioning unit sales will be units of 5 tons capacity or less.

7. Better service continuity can be provided with single-phase.

8. Service voltage problems are reduced when only single-phase is used.

SEARCHLIGHT SECTION

(*Classified Advertising*)

EMPLOYMENT: BUSINESS: **"OPPORTUNITIES"** :EQUIPMENT :USED OR RESALE

DISPLAYED RATE: ———RATES——— **UNDISPLAYED RATE:**

EMPLOYMENT OPPORTUNITIES: $22.87 per inch. Subject to Agency Commission.
EQUIPMENT & BUSINESS OPPORTUNITIES: $16.85 per inch for all advertising appearing on other than a contract basis. Not subject to Agency Commission. **ON ADVERTISING INCH** is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page.
EQUIPMENT WANTED or FOR SALE ADVERTISEMENTS acceptable only in Displayed Style.

$1.80 a line, minimum 3 lines. To figure advance payment count 5 average words as a line.

PROPOSALS, $1.80 a line an insertion.

BOX NUMBERS count as one line additional in undisplayed ads.

DISCOUNT OF 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

Send New Advertisements to Classified Advertising Div. of Electrical World, P. O. Box 12, N. Y. 36, N. Y.

SUBSTATION EQUIPMENT

TRANSFORMER

QU.	KVA	MFGR	VOLTAGE
4	1667	Mol.	69,000–34,500
3	1500	G.E.	66,000–2400/4160
3	833	West.	66,000–6,900/11950
3	500	Wagner	69,000–460
4	333	West.	67,000–7200
1	2500	Mol.	44,000–2400/4160, 3 Ph.
3	500	G.E.	44,000–2400/4160
3	200	West.	44,000–480
1	5000	West.	34,500–13750/6875, 3 Ph.
1	3750	G.E.	34,400–13800, 7960, 3 Ph.
2	3000	Uptegraff	34,750–4160, 3 Ph.
2	1500	G.E.	34,400–2520, 3 Ph.
3	1000	A.C.	34,650/11,500–2300
4	333	G.E.	34,650–7200/12470Y
3	200	A.C.	34,500–2400/7200/12470Y
2	1500	G.E.	23,000–2400/4800, 3 Ph.
1	7500	A.C.	13,800–2400, 3 Ph.
3	2500	G.E.	13,800–2300, 3 Ph.
3	1667	G.E.	13,800–600
3	667	Kuhl.	13,800–480
1	600	Stand.	13,200–2300, 3 Ph.
1	450	Penna.	13,200–2400, 3 Ph. Askarel
1	4500	West.	7200–2400, 3 Ph.
3	333	Mol.	7200/12470–2400/4160
3	100	G.E.	7,200/12470–240/480
3	125	A.C.	6900–2300
3	100	G.E.	4800–120/240
3	400	G.E.	2300/4000–230/460
3	333	G.E.	2400/4160–600
3	100	G.E.	2300/4000–230/460

FEEDER REGULATORS—OUTDOOR

1	750	G.E.	360 A. 12000 V. 3 Ph. STEP
1	500	G.E.	694 A. 4160 V. 3 Ph. STEP
1	375	G.E.	50.2 A. 34500 V. 3 Ph. STEP
1	250	A.C.	601 A. 2400 V. 3 Ph. STEP
3	96	G.E.	200/400 A., 2400 V. 1 Ph. IND.
8	36	West.	150/300 A., 2400 V. 1 Ph. IND.

Also: FREQ. CHRGS., M-G SETS, SYn CONDENSERS, OIL CIR. BRKRS, ETC.

BREW, WOLTMAN & CO., INC.
52 Church Street New York 7, N. Y.

TRANSFORMERS

3—500 KVA G-E 22000-2300/4000Y
3—500 KVA W-H 13200-2300/4000Y
3—500 KVA G-E 7200-2400/4160Y
3—400 KVA W-H 11500-2400/4800
3—333 KVA G-E 2400-240x480
3—333 KVA W-H 2400-120x240
6—167 KVA G-E 7200-2400/4160Y
1—750/938 KVA G-E 3-Ph. 33000-6900Y TCUL equip. fan cooling
1—1000 KVA W-H 3-Ph. 33000-7200Y TCUL equip.
1—1500 KVA W-H 3-Ph. 13200-480
1—2000 KVA W-H 3-Ph. 13800-2400

Many Other Items in Stock

TRANSFORMERS WANTED
Reliable rewind and repair service on all makes of transformers

THE ELECTRIC SERVICE CO.
5331 Hetzel St.
Cincinnati 27, Ohio
45 Years' Dependable Service

MOTORS • GENERATORS
TRANSFORMERS
NEW • REBUILT
ELECTRIC EQUIPMENT CO.
WORLD'S LARGEST INVENTORY
CALL COLLECT GL 3-6783
P. O. BOX 51 • ROCHESTER 1, N. Y.

LARGE POWER EQUIPMENT

Prompt Stock Shipment
RENUBILT MOTORS - GENERATORS
TRANSFORMERS - CIRCUIT BREAKERS
DO YOU GET OUR STOCK LIST?
BELYEA COMPANY, INC.
51 Howell St. Jersey City, N. J.
OL-3-3334

ADDRESS BOX NO. REPLIES TO: Box No. Classified Adv. Div. of this publication. Send to office nearest you.
NEW YORK 36: P. O. BOX 12
CHICAGO 11: 520 N. Michigan Ave.
SAN FRANCISCO 4: 68 Post St.

POSITIONS VACANT

Wanted—University graduate Engineer with at least five years experience operation steam electric generating station for responsible position in Maracaibo, Venezuela. Preference will be given Spanish speaking applicant. Salary dependent on qualifications. P-8320.

Engineer for design, development and testing compression fittings for power lines. BSME or BSEE. Experience in design and construction of transmission and distribution helpful, but will consider recent grad. Good fringe benefits. NW Chicago suburb. Salary open. Reliable Electric Company, 11333 Addison Street, Franklin Park, Illinois.

OFFICIAL PROPOSAL

DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Invitation No. DS-5141) will be received at Denver, Colorado, until 2 p.m., Mountain Standard Time, February 24, 1959, for furnishing three, 230-kv, 1,200-amp, 5,000,000-kva and one 14.4-kv, 2,000-amp, 1,500,000-kva power circuit breakers for Granite Falls Substation, Missouri River Basin Project, North Dakota. Delivery is desired within 450 days. For particulars, address Bureau of Reclamation, Building 53, Denver Federal Center, Denver 2, Colorado. W. A. Dexheimer, Commissioner.

"SEARCHLIGHT" IS

Opportunity Advertising

—to help you get what you want.

—to help you sell what you no longer need.

Take Advantage Of It

For Every Business Want
"Think Searchlight First"

PROFESSIONAL SERVICES

AMERICAN AIR SURVEYS, INC.

- Aerial Topographic Maps & Photos
- Plan & Profile for Transmission Lines
- Aerial Stereo-photos for Planning
- Topographic Maps for Reservoir Studies
- Coal Stockpile Volumes by Aerial Method

Reps.—Chicago-Huntington, W. Va.

907 Penn Avenue — Pittsburgh 22, Pa.

BARKER & WHEELER

Utility and Industrial Valuations, Design and Construction of Power Systems, Water Supplies, Sewerage and Sewage Disposal, Factory Production and Cost Control Systems.

11 Park Place, New York City
36 State Street, Albany, N. Y.

BLACK & VEATCH

Consulting Engineers

Electricity—Water—Sewage—Industry

Reports, Design, Supervision of Construction
Investigations, Valuations and Rates

1500 Meadow Lake Parkway — Kansas City 14, Mo.

BROOKLYN ENGINEERING CORP.

Utilities Erectors & Consultants

Baltimore 26, Md.

Power Plant equipment erection, mechanical and electrical construction from manufacturers and engineers drawings. Supervision by general power engineering staff for heat cycle coordination. Improvements—Modifications—etc.

THEODORE D. BROSS LINE CONSTRUCTION CORP.

Steel Tower & Wood
Transmission Lines

Distribution & Maintenance

175 Endfield St. — Hartford, Conn.

BURNS and ROE, Inc.

Engineering and Design • Reports • Surveys
Construction • Electric, Steam, Hydro Plants
Transmission • Distribution • Aeronautical
Facilities • Research and Development • Nuclear, Chemical, and Industrial Plants

160 West Broadway • New York 13, N. Y.

COMMONWEALTH SERVICES INC.

Management and
Business Consultants
300 Park Ave.
New York 22, N. Y.

ASSOCIATES INC.

Consulting and Design
Engineers
209 E. Washington
Jackson, Michigan

DOBLE ENGINEERING COMPANY

Electrical Insulation Engineers

Field Testing and Maintenance of High Tension Insulation, Special Problems in Electrical Communications

Office and Laboratory: Doble Park
Box 344, Belmont 78, Mass. (6 miles from Boston)
Branch Office: 20 N. Wacker Dr., Chicago, Ill.

ELECTRICAL TESTING LABORATORIES, INC.

Electrical, Electronic, Environmental, Photometric and Chemical Laboratories. Testing, Research, Inspection and Certification.

2 East End Ave. — New York 21, N. Y.

FORD, BACON & DAVIS

Engineers

DESIGN • CONSTRUCTION
VALUATIONS • REPORTS

New York • Chicago • Los Angeles

GIBBS & HILL, Inc.

Consulting Engineers—Designers—Constructors

Steam, Hydroelectric, Gas-Turbine & Nuclear Power Generation—Electric Transmission & Distribution Systems—Power Surveys, Reports & Contracts—Industrial, Transportation & Communication Facilities—Water & Waste Treatment Works.

Los Angeles — NEW YORK 1, N. Y. — Tampa

GILBERT ASSOCIATES, INC.

Engineers and Consultants

DESIGN
SUPERVISION OF CONSTRUCTION
BUSINESS AND ECONOMIC RESEARCH
READING, PA.

Washington — New York

HARZA ENGINEERING CO.

Consulting Engineers

Calvin V. Davis — E. Montford Fucik
Richard D. Harza
Hydroelectric Plants and Dams
Transmission Lines
Flood Control, Irrigation
River Basin Development

400 West Madison Street — Chicago 6

HOOSIER ENGINEERING COMPANY

Erection and Maintenance of Electrical Transmission and Distribution Lines

1384 Holly Avenue, Columbus, Ohio

JACKSON & MORELAND, INC.

JACKSON & MORELAND INTERNATIONAL, INC.
Engineers and Consultants

Electrical—Mechanical—Structural
Design and Supervision of Construction for Utility, Industrial and Atomic Projects
Surveys—Appraisals—Reports
Machine Design—Technical Publications

Boston — New York

JENSEN, BOWEN & FARRELL

Engineers

Appraisals—Investigations—Depreciation Studies—Cost Trends—Reports for Rate Cases, Security Issues, Regulatory and Accounting, Requirements
Original Cost and Continuing Property Record Determination
Ann Arbor, Michigan

THE KULJIAN CORPORATION

Engineers - Constructors - Consultants

POWER PLANT SPECIALISTS
(Steam, Hydro, Diesel)
Utility • Industrial • Chemical

1200 N. Broad St., — Philadelphia 21, Pa.

PETER F. LOFTUS CORPORATION

Design and Consulting Engineers

Electrical • Mechanical • Structural
Civil • Nuclear • Architectural

First National Bank Building
Pittsburgh 22, Pennsylvania

CHAS. T. MAIN, INC.

Engineers

Electric, Steam and Hydraulic Projects,
Investigations, Reports, Appraisals
Design and Construction Supervision

Boston, Mass. — Charlotte, N. C.

PIONEER SERVICE & ENGINEERING CO.

Consulting and Design
Engineers . . Purchasing
Specialists in Financing
Accounting and other Operations

231 So. La Salle St. — Chicago 4

SARGENT & LUNDY

Engineers

140 South Dearborn St.

Chicago, Ill.

SVERDRUP & PARCEL

Engineers & Consultants

Design, Construction Supervision
Steam and Hydro Power Plants
Power Systems - Industrial Plants
Studies - Reports

St. Louis — San Francisco — Washington

TIPPETT & GEE

Consulting Engineers

Mechanical • Electrical • Thermodynamic
Structural Design • Studies • Supervision
Power Stations • Transmission • Distribution
Industrial Plants • Process

1333 North Second Street — Abilene, Texas

UTILITIES LINE CONSTRUCTION COMPANY, INC.

Construction and Maintenance

Transmission - Distribution
Electric and Telephone Lines
Consultants

505 York Road — Jenkintown, Pa.

VERNON GRAPHICS, INC.

VERNON GRAPHICS OF PA. INC.

CONSULTING AND SERVICING UTILITIES
ON MAPS, RECORDS AND FIELD INVENTORY

Mount Vernon, N. Y.
MO 4-7117

Norristown, Pa.
Broadway 9-3000

THE J. G. WHITE ENGINEERING CORPORATION

Design • Construction • Reports • Appraisals

80 Broad Street, New York 4

READERS MAY CONTACT

the consultants whose cards appear on this page with the confidence justified by the offering of these special services NATIONALLY.

The Meetings Calendar

JANUARY

• **Electric Companies Public Information Program**—Mid-Atlantic Region, Hall of Flags East, Sheraton Hotel, Philadelphia, Pa., Jan. 20; 1959 PIP Workshop Conference Committee, Hall of Flags East, Sheraton Hotel, Philadelphia, Pa., Jan. 21; East North Central Region, Detroit, Jan. 27; West North Central Region, Schroeder Hotel, Milwaukee, Wisc., Jan. 29.

• **The American Institute of Mining, Metallurgical, & Petroleum Engineers**—Mechanical Working Committee, Iron and Steel Division, Hotel Del Prado, Chicago, Ill., Jan. 21.

Pennsylvania Electric Association — Communications Committee, Hotel Pick-Roosevelt, Pittsburgh, Pa., Jan. 22-23; System Operation Committee, Fort Stanwix Hotel, Johnston, Pa., Jan. 29-30; Structures and Hydraulics Committee, Benjamin Franklin Hotel, Philadelphia, Pa., Jan. 29-30.

Power & Communications Contractors Association—14th Annual Convention, Shamrock Hilton, Houston, Texas, Jan. 25-27.

• **Plant Maintenance & Engineering Show**—Public Auditorium, Cleveland, Ohio, Jan. 26-29.

Canadian Electrical Association—Eastern Zone Section Meetings, Chateau Frontenac, Quebec,P. Q., Canada, Jan. 26-29.

American Society of Heating & Air-Conditioning Engineers—14th International Heating & Air-Conditioning Exposition, Convention Hall, Philadelphia, Pa., Jan. 26-29.

Doble Clients Conference — 26th Annual Meeting, Sheraton Plaza Hotel, Boston, Mass., Jan. 26-30.

Midwest Welding Conference—5th Annual Conference sponsored by Armour Research Foundation of Illinois Institute of Technology and the Chicago section of the American Welding Society, Chemistry Building, Illinois Tech campus, Jan. 28-29.

Public Utilities Advertising Association — Regional Meeting, Timberline Lodge, Portland, Oregon, Jan. 29-30.

FEBRUARY

American Institute of Electrical Engineers—Winter General Meeting, Statler and Sheraton-McAlpin Hotels, New York City, Feb. 1-6.

American Society for Testing Materials — Committee Week Meeting, Penn-Sheraton Hotel, Pittsburgh, Pa., Feb. 2-6.

Edison Electric Institute—Prime Movers Committee, Hotel Beaumont, Beaumont, Texas, Feb. 2-4; Commercial Lighting Committee, Philadelphia, Pa., Feb. 5-6; Electric Space Heating & Air Conditioning Committee, Los Fresnos, Texas, Feb. 9-10; Transmission & Distribution Committee, Morrison Hotel, Chicago, Ill., Feb. 12-13; EEI-AGA Accounting Conference, Final Working Committee, Lord Baltimore Hotel, Baltimore, Md., Feb. 16-17; Electrical System & Equipment Committee, Atlanta Biltmore Hotel, Atlanta, Ga., Feb. 16-17; Area Development Committee, New York City, Feb. 27.

Pennsylvania Electric Association—Transmission & Distribution Committee, Hotel Benjamin Franklin, Philadelphia, Pa., Feb. 5-6; Prime Movers Committee, Hotel Pick-Roosevelt, Pittsburgh, Pa., Feb. 12-13; System Planning Committee, Hotel Bellevue-Stratford, Philadelphia, Pa., Feb. 16-17; Electrical Equipment Committee, Hotel Benjamin Franklin, Philadelphia, Pa., Feb. 19-20; Relay Committee, Hotel Pick-Roosevelt, Pittsburgh, Pa., Feb. 26-27.

Missouri Valley Electrical Association—Industrial and Commercial Sales Conference, President Hotel, Kansas City, Mo., Feb. 5-6.

National Association of Purchasing Agents—Public Utiilties Buyers Group Mid-Winter Meeting, Chase Hotel, St. Louis, Mo., Feb. 8-10.

National Electrical Week—February 8-14.

National Rural Electric Coop Association — Annual Meeting, Shoreham and Sheraton-Park Hotels, Washington, D. C., Feb. 9-12.

American Society of Civil Engineers—Los Angeles Convention, Los Angeles, Calif., Feb. 9-13.

Pacific Coast Electrical Association — Business Development Conference, Hotel Sheraton-Palace, San Francisco, Calif., Feb. 12-13.

American Institute of Mining, Metallurgical, and Petroleum Engineers, Inc—Annual Meeting, Hotels St. Francis, Sheraton-Palace, Sir Francis Drake, San Francisco, Calif., Feb. 15-19.

• **American Management Association**—Mid-winter Personnel Conference, Palmer House, Feb. 16-18.

Electrical Trade Conference & Exposition — Sheraton Park Hotel, Washington, D. C., Feb. 17-19.

• **American Marketing Association**—Fifth Annual Public Utilities Seminar, Detroit, Michigan, Feb. 19-20.

American Public Power Association—Engineering & Operations Workshop, Springfield, Illinois, Feb. 19-20.

National Society of Professional Engineers — Winter Meeting, Dinkler-Tutwiler Hotel, Birmingham, Ala., Feb. 19-21.

• Additions this week.

Advertising Index

Allis-Chalmers Mfg. Co....2nd cover, 26
Associated Research, Inc..... 58

Burndy Corp. .....3rd cover

Circle Wire & Cable Corp..... 61
Colorado Fuel & Iron Corp., Wickwire Spencer Steel Div..... 52

Delta-Star Electric Division H. K. Porter Company, Inc..... 62
Directory of Engineers..... 80
duPont de Nemours & Co., (Inc.) Polychemicals Dept. 59

Electric Service Works, Delta-Star Electric Division, H. K. Porter Company, Inc. 62
Engineers, Directory of..... 80
English Electric Co., Ltd..... 19
Esco Mfg. Co..... 75

Fanner Mfg. Co..... 54
Federal Pacific Electric Co..... 10
Ferranti Ltd. 49

Gulf Oil Corporation.....20, 21
Gulton Industries, Inc..... 60

Indiana Steel & Wire Co., Inc..... 74

Jennings Radio Mfg. Corp..... 7

Kuhlman Electric Co.....4th cover

Lapp Insulator Co., Inc..... 57

Mallory & Co., Inc., P. R..... 53
Moloney Electric Co.....8, 9

Ohio Brass Co.....15, 16, 17, 18
Okonite Co. 4

Pennsylvania Transformer Div. McGraw-Edison Co. 43, 44, 45, 46

Roebling's Sons Corp., John A..... 23
Rome Cable Corp.....72, 73

S&C Electric Co..... 71
Sangamo Electric Co..... 6
Searchlight Section 81
Sel-Rex Corp. 75
Shaw-Perkins Mfg. Co..... 58
Square D Company..... 55

Technicon Controls, Inc..... 22
Tobe Deutschmann Corp.....50, 51

United States Steel Corp..... 25

Wagner Electric Corp..... 77
Westinghouse Electric Corp...67, 68, 69
Wheeler Mfg. Co., C. H..... 24

PROFESSIONAL SERVICES 81

CLASSIFIED ADVERTISING
F. J. Eberle, Business Mgr.

EMPLOYMENT OPPORTUNITIES 80

EQUIPMENT (Used or Surplus New) For Sale 80

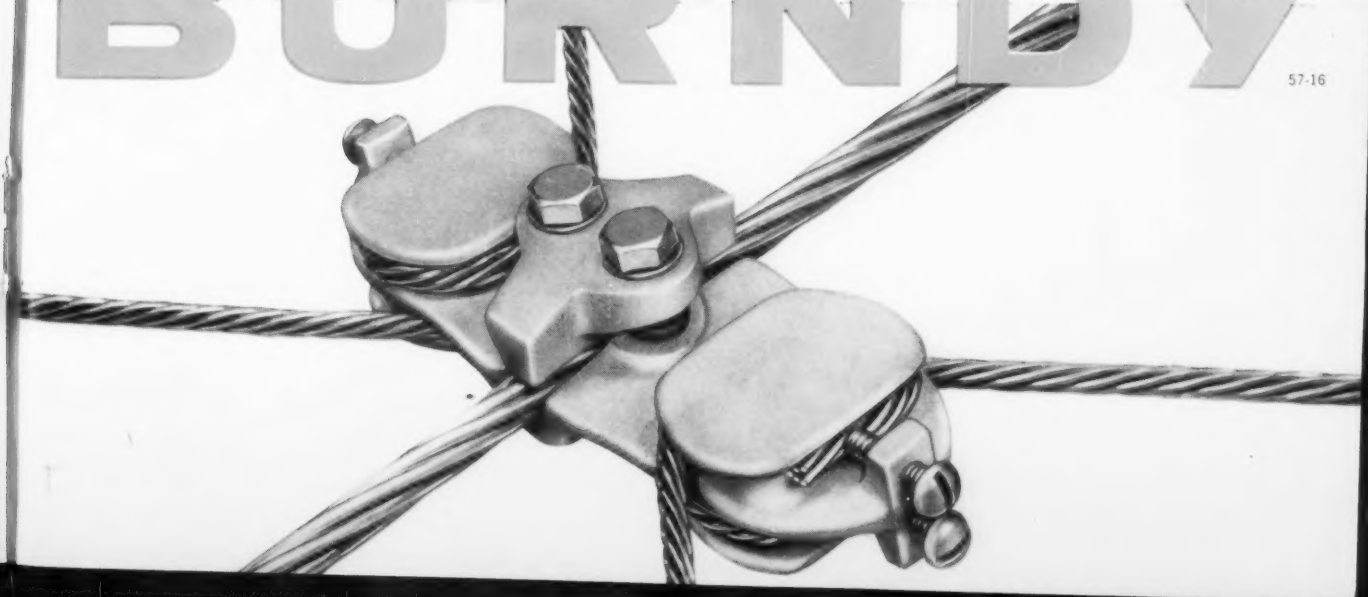
SPANTAP

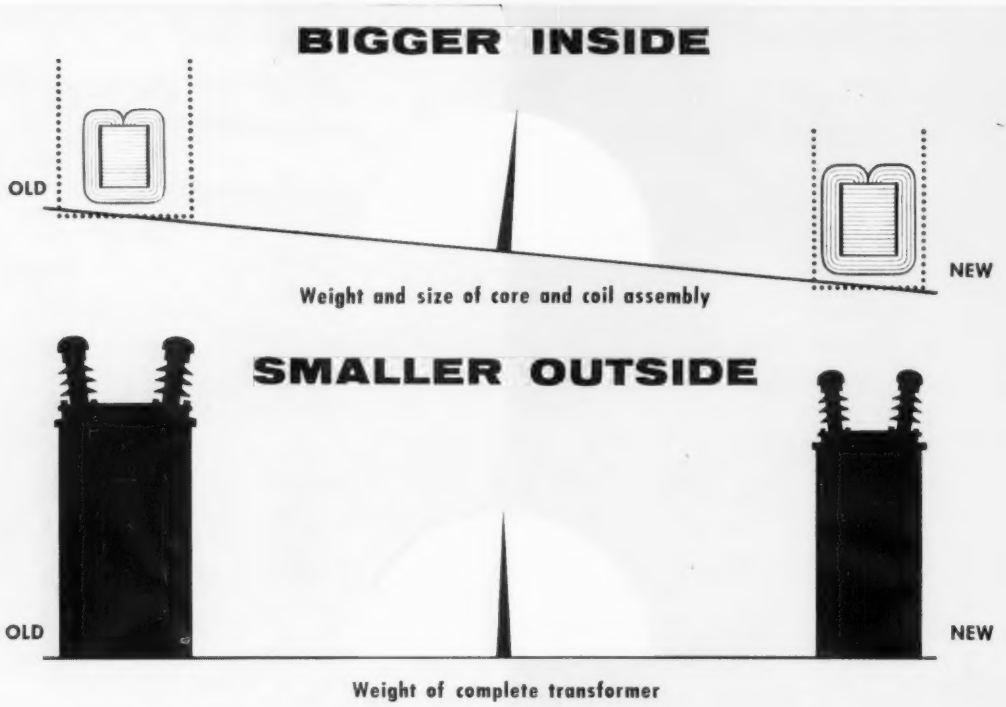
first fully engineered MID-SPAN TAP for cabled secondaries

- The phase SPANTAP, above, is installed on the run by tightening a single bolt! The insulating cover halves snap together...securely held by humpback cotter pins. Knockouts in the insulating cover permit insertion of taps without removing this cover!
- Up to 4 individual taps can be taken from one SPANTAP! Each service can be added or removed from the installed and fully-insulated SPANTAP... at any time!
- The stripping length for each tap is indicated on the face of the cover! The connection is made secure by tightening pressure bar assembly from the bottom of the SPANTAP.
- One neutral SPANTAP, below, deadends and connects up to 4 service drop neutrals to the neutral of the secondary — without disassembly of the connector.
- The service drop neutral is wrapped around the SPANTAP V-groove which produces a wedge-locked grip on the conductor. As stresses increase, the simple connection grows tighter!
- No further gripping action is required but the neutral SPANTAP has an anchor screw to secure each connection against severe winds and storms!
- Write for complete technical specifications. Burndy, Norwalk, Connect., Scarboro, Canada.

BURNDY

57-16





Here's why you get more for your transformer dollars this year

NEW KUHLMAN DESIGNS ARE *BIGGER* INSIDE, *SMALLER* OUTSIDE

Larger core and coil, using more copper and steel, provide lower losses, improved impedance, and better regulation. A smaller tank takes up less room on the pole and offsets the increased size and weight of the stepped-up core and coil.

With the new Kuhlman '59 Transformer—bigger inside, smaller outside—Kuhlman engineers continue the advances begun with the Kuhlman "Bent Iron" Core. For more than a quarter-century, this has been the most-used principle, industry-wide, to achieve highest transformer efficiency at the lowest possible weight. With the improvement in steel, the Bent Iron Core has done more than any other single thing to make today's lightweight pole transformer possible.

"Bigger inside, smaller outside" is one of the reasons why Kuhlman's 65th year is a big year for you. This year, more than ever, you get more for your transformer dollar from Kuhlman.

Get all the facts from the Kuhlman representative near you.

ALL NEW INSIDE . . .

Conventional above 5KV | Conventional 5KV and below | CSP® | Rural

KUHLMAN ELECTRIC COMPANY

65th year

the year you get more for your transformer dollars

KUHLMAN TRANSFORMERS

KUHLMAN ELECTRIC COMPANY, Birmingham, Mich.

Plants at Bay City, Michigan; Crystal Springs, Mississippi; Salinas, California